ANNUAL REGISTER

OF THE

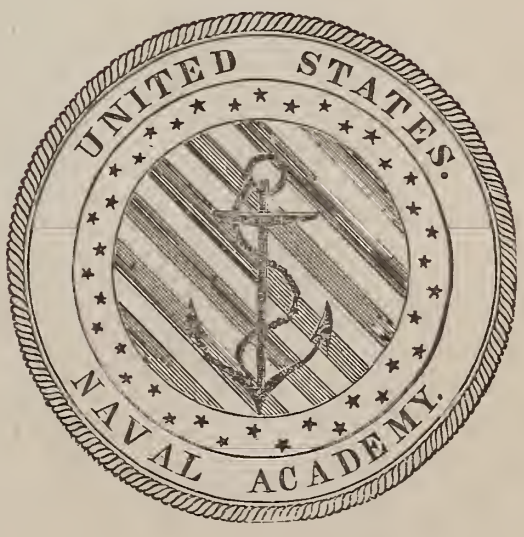
UNITED STATES NAVAL ACADEMY,

AT

ANNAPOLIS, MD.

TWENTY-FIFTH ACADEMIC YEAR,

1874-75.



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1874.

CONTENTS.

THE

UNITED STATES NAVAL ACADEMY.

The United States Naval Academy was founded in 1845, by George Bancroft, Secretary of the Navy, in the administration of President James K. Polk. It was formally opened October 10, of that year, under the name of the Naval School, with Commander Franklin Buchanan as Superintendent. It was placed at Annapolis, Md., on the land occupied by Fort Severn, which was given up by the War Department for the purpose. The School at its establishment numbered 56 Midshipmen, of whom 36, of the date of 1840, were preparing for examination; 13, of the date of 1841, were to remain at their studies until ordered to sea; and 7, just appointed, were to take the regular course, which was fixed as one year at the School, three years at sea, and a fifth and final year at the School, before promotion. Later, the course was altered to seven years, of which the first two and last two were at the School, and the intervening years at sea.

In October, 1849, a board of officers was appointed to re-organize the School. A new system was devised and carried into operation, July 1, 1850. By this, the course of instruction was made more extensive, and arranged to cover four consecutive years; the corps of Professors was increased, and a Sloop-of-war, the Preble, was attached to the School as a practice-ship. The new school was called the Naval Academy, and was placed under the supervision of the Chief of the Bureau of Ordnance and Hydrography. A board of visitors was appointed to examine into the state of the Academy annually, and to make a report upon its condition to the Secretary of the Navy. The first class of Acting Midshipmen under the four years' course entered in October, 1851, and was graduated in June, 1854. The previous course was retained for all who had entered the service before this time, those of the date of 1850 being graduated in 1856.

In May, 1861, on the outbreak of the war, the Academy was removed to Newport, R. I. The three upper classes were detached and ordered to sea, and those remaining were quartered in the Atlantic House, and on board the Frigate Constitution. In September, 1865, the Academy was restored to Annapolis, where it has since remained.

On the establishment of the Bureau of Navigation, July 5, 1862, the Academy was placed under its supervision; March 1, 1867, it was placed under the direct care and supervision of the Navy Department, the administrative routine and financial management being still conducted through the Bureau. This system was followed till March 11, 1869, when all connection with the Bureau ceased.

The term of the academic course was changed by law, March 3, 1873, from four to six years. The change took effect with the class which entered in the following summer.

In 1866, a class of Acting Third Assistant Engineers was ordered to the Academy for instruction. The course embraced the subjects of steam-engineering, iron-manufacture, chemistry, and mechanics, and practical exercises with the steam-engine and in the machine-shop. This class was graduated in June, 1868, together with two Cadet-Engineers who had entered the Academy in 1867. After an interval of four years, in October, 1871, a new class of Cadet-Engineers was admitted. This class followed a two years' course, somewhat more extended than that of the class of 1868, and was graduated in 1873. In 1872 and 1873, new classes were admitted, the first of which left the Academy last summer. By an act of Congress, approved February 24, 1874, the course of instruction for Cadet-Engineers was made four years, instead of two; and the new provision was first applied to the class entering the Academy in the year 1874.

There are, therefore, three classes of Cadet-Engineers now at the Academy: the First, which entered in 1873, and which will be graduated in due course in 1875; the Second, composed of Cadets turned back from the First Class on account of deficiency in scholarship, and whose course ends in 1876; and the Fourth Class, just admitted by competitive examination, which will be graduated under the four years' rule in June, 1878.

BOARD OF VISITORS, JUNE, 1874.

Rear-Admiral WILLIAM REYNOLDS, U. S. N., *President.*
Hon. AARON A. SARGENT, United States Senate, *Vice-President.*
Hon. JOHN W. STEVENSON, United States Senate.
Hon. EUGENE HALE, United States House of Representatives.
Hon. L. Q. C. LAMAR, United States House of Representatives.
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Hon. WILLIAM E. AIKEN, of South Carolina.
Rev. J. L. G. McKOWN, of Illinois.
General J. H. WILSON, of New York.
General W. H. MORGAN, of Missouri.
Col. D. P. DYER, of Missouri.
Capt. S. B. LUCE, U. S. N.
Chief Engineer W. H. SHOCK, U. S. N.

CALENDAR.

1874-75.

1874.

June 5.—Examination of candidates for admission as Cadet-Midshipmen began ..... Friday.
June 15.—Examination of candidates concluded ..... Monday.
July 4.—Holiday ..... Saturday.
Sept. 15.—Examination of candidates for admission as Cadet-Engineers began ..... Tuesday.
Sept. 18.—Examination of candidates for admission as Cadet-Engineers concluded ..... Friday.
Sept. 21.—Examination of candidates for admission as Cadet-Midshipmen began ..... Monday.
Sept. 30.—Examination of candidates for admission as Cadet-Midshipmen concluded ..... Wednesday.
Oct 1.—First Term began ..... Thursday.
Nov. 26.—Thanksgiving: studies, recitations, exercises, and duty suspended ..... Thursday.
Dec. 25.—Christmas: studies, recitations, exercises, and duty suspended. Friday.

1875.

Jan. 1.—New Year's Day: studies, recitations, exercises, and duty suspended ..... Friday.
Jan. 25.—Semi-annual examination begins ..... Monday.
Jan. 30.—Semi-annual examination concluded. First Term ends ..... Saturday.
Feb. 1.—Second Term begins ..... Monday.
Feb. 22.—Holiday ..... Monday.
May 20.—Annual examination begins ..... Thursday.
May 30.—Annual examination concluded. Second Term ends ..... Monday.

PRACTICE CRUISE.

JUNE—SEPTEMBER, 1875.

June 5.—Examination of candidates for admission as Cadet-Midshipmen begins ..... Saturday.
June 8.—Examination of candidates for admission ends ..... Tuesday.
Sept. 15.—Examination of candidates for admission as Cadet-Engineers. Wednesday.
Sept. 20.—Examination of candidates for admission as Cadet-Midshipmen begins ..... Monday.
Sept. 23.—Examination of candidates for admission as Cadet-Midshipmen ends ..... Thursday.
Oct. 1.—First Term (1875-76) begins ..... Friday.

CALENDAR FOR 1874-75.

OCTOBER.

S.	M.	T.	W.	T.	F.	S.
....	....	....	....	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31

NOVEMBER.

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DECEMBER.

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13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	....	....

JANUARY.

....	....	....	....	....	1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31	....	....	....	....	....	....

FEBRUARY.

....	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	...	....	....	....	....	....

MARCH.

...	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31	....	....	....

APRIL.

S.	M.	T.	W.	T.	F.	S.
....	....	....	....	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	....

MAY.

....	....	....	....	....	....	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	....	....	....	....	....

JUNE.

....	....	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	....	....	....

JULY.

....	....	....	....	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	31
....	....	....	....	....	....	....

AUGUST.

1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	....	....	.....	

SEPTEMBER.

....	....	....	1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	....	....

OFFICERS

OF THE

UNITED STATES NAVAL ACADEMY.

REAR-ADMIRAL
CHRISTOPHER RAYMOND PERRY RODGERS,
SUPERINTENDENT.

ACADEMIC STAFF.

CAPTAIN KIDDER RANDOLPH BREESE,
Commandant of Midshipmen,
and
Head of the Departments of Seamanship and of Ordnance and Gunnery.

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Assistant to Commandant of Midshipmen,
and
Senior Instructor in Seamanship, Naval Tactics, and Naval Construction.

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LIEUTENANT-COMMANDER COLBY MITCHELL CHESTER,
LIEUTENANT-COMMANDER HENRY CHAMPLIN WHITE,
LIEUTENANT EUGENE DE FOREST HEALD,
Assistants to Commandant of Midshipmen,
and
Instructors in Seamanship, Naval Tactics, and Naval Construction.

MATTHEW STROHM,
Instructor in Boxing, Swimming, and Gymnastics.

ORDNANCE AND GUNNERY.

COMMANDER EDWARD TERRY,
Assistant to Commandant of Midshipmen,
and
Senior Instructor in Naval Gunnery and Infantry Tactics.

LIEUTENANT-COMMANDER ALBERT GALLATIN CALDWELL,
LIEUTENANT-COMMANDER BOWMAN HENDRY McCALLA,
LIEUTENANT SIDNEY AUGUSTUS SIMONS,
LIEUTENANT CHARLES CARPENTER CORNWELL,
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A. J. CORBESIER,
Sword-Master.

J. B. RETZ,
GEORGE HEINTZ,
Assistant Sword-Masters.

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LIEUTENANT-COMMANDER FRENCH ENSOR CHADWICK,
LIEUTENANT-COMMANDER SAMUEL HOUSTON BAKER,
LIEUTENANT WILLARD HERBERT BROWNSON,
LIEUTENANT ASA WALKER,
LIEUTENANT CHARLES STILLMAN SPERRY,
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PASSED ASSISTANT ENGINEER JOHN LIVINGSTON DINWIDDIE BORTHWICK, M. A.
PASSED ASSISTANT ENGINEER GEORGE EDWARD TOWER,
PASSED ASSISTANT ENGINEER DAVID JONES.
PASSED ASSISTANT ENGINEER CHARLES HENRY MANNING,
ASSISTANT ENGINEER CHARLES WHITESIDE RAE, C. E.,
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LIEUTENANT RAYMOND PERRY RODGERS,
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LIEUTENANT-COMMANDER SILAS WRIGHT TERRY,
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PROFESSOR JOHN MINOT RICE, S. B.,
LIEUTENANT MORRIS ROBINSON SLIDELL MACKENZIE,
Instructors in Applied Mathematics and Mechanics.

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LIEUTENANT EDWARD PARKER WOOD,
ASSISTANT PROFESSOR WILLIAM WIRT FAY, A. M.,
ASSISTANT PROFESSOR FREEMAN SNOW, A. B.,
ASSISTANT PROFESSOR ELIOT LORD, A. B.,
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ASSISTANT PROFESSOR PEDRO MONTALDO,
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PROFESSOR LUCIEN FRANKLIN PRUD'HOMME,
ASSISTANT PROFESSOR ALPHONSE V. S. COURCELLE,
ASSISTANT PROFESSOR EUGENE DOVILLIERS,
ASSISTANT PROFESSOR JULES LEROUX,
ASSISTANT PROFESSOR HIPPOLYTE DALMON,
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DRAWING.

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Head of Department.

ASSISTANT PROFESSOR MARSHAL OLIVER,
ASSISTANT PROFESSOR CHARLES FRANCIS BLAUVELT, N. A.,
Instructors in Drawing.

OFFICERS NOT ATTACHED TO THE ACADEMIC STAFF.

COMMANDER NORMAN VON HELDREICH FARQUHAR, *in charge of Vessels.*
COMMANDER SAMUEL DANA GREENE, *in charge of Grounds.*
PAY-INSPECTOR JAMES DANIEL MURRAY.
PAYMASTER SAMUEL TRACEY BROWNE, *Storekeeper.*
SURGEON GEORGE ADAMS BRIGHT, M. D.
ACTING PASSED ASSISTANT SURGEON JOSEPH JOHN SOWERBY, M. D.
ACTING ASSISTANT SURGEON THOMAS OLIVER WALTON, M. D.
CHAPLAIN JOHN RUTHERFORD MATTHEWS, M. A.
ASSISTANT PROFESSOR THOMAS KARNEY, A. M., *Librarian.*
JAMES JOHNSON GRAFF, *Assistant Librarian.*
RICHARD SWANN, *Commissary.*
RICHARD MOALE CHASE, *Secretary.*

JAMES G. GLYNN, *First Clerk.*
SAMUEL JICKLING, *Second Clerk.*
OWEN DORSEY ROBB, *Third Clerk.*
CHARLES MARION MCLEOD, *Clerk to Commandant of Midshipmen.*

MARINE GARRISON.

CAPTAIN MCLANE TILTON, *Commanding.*
FIRST LIEUTENANT HENRY CLAY COCHRANE.
FIRST LIEUTENANT DANIEL PRATT MANNIX.
FIRST LIEUTENANT SAMUEL KUYPERS ALLEN.
SECOND LIEUTENANT SAMUEL HOPPER GIBSON.

MATES.

C. J. MURPHY, WILLIAM G. SMITH, L. M. MELCHER, T. W. BONSALL — *Attached to the United States Gunnery-ship Santee, and to the Sloop-of-war Dale.*
ROBERT SILVER — *Attached to the United States Steamer Lehigh, (iron-clad.)*
BENJAMIN G. PERRY, JOSEPH RODGERS — *Attached to the United States Steamer Phlox, (steam-tender.)*

ACADEMIC BOARD.

REAR-ADMIRAL C. R. P. RODGERS, U. S. N.
CAPTAIN K. R. BREESE, U. S. N.
COMMANDER EDWARD TERRY, U. S. N.
COMMANDER F. V. McNAIR, U. S. N.
COMMANDER W. S. SCHLEY, U. S. N.
COMMANDER W. T. SAMPSON, U. S. N.
CHIEF ENGINEER C. H. BAKER, U. S. N.
LIEUTENANT-COMMANDER A. H. McCORMICK, U. S. N.
PROFESSOR W. W. HENDRICKSON, U. S. N.
PROFESSOR R. S. SMITH, A. M.
PROFESSOR J. R. SOLEY, A. B.

CADET-OFFICERS.

CADET LIEUTENANT-COMMANDER.

CAMERON M. WINSLOW.

CADET-LIEUTENANTS.

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WALTER S. HUGHES.
JAMES M. HELM,
FYDELIO S. CARTER.

CADET-MASTERS.

CHARLES H. AMSDEN.
ALEXANDER SHARP.
HENRY J. HUNT,
RICHARD H. TOWNLEY.

CADET-ENSIGNS.

WILLIAM B. CAPERTON.
DAVID DANIELS.
HARRY M. HODGES.
RIDGELY HUNT.

CADET PETTY-OFFICERS.

First Captains of Guns' Crews.

Edward D. Bostick.
William G. Cutler.
Alfred L. Howe.
Harry H. Hosley.
Charles Laird.
Charles M. McCartney.
John A. Shearman.
James T. Smith.
George Stoney.
Nathaniel R. Usher.
Frederick B. Vinton.
Augustus E. Jardine.
Stimson J. Brown.
Henry C. Gearing.
Templin M. Potts.
George C. Foulk.

Second Captains of Guns' Crews.

Clarence A. Corbin.
Frederick W. Coffin.
Robert N. Doyle.
Frank F. Fletcher.
George H. Worcester.
Burns T. Walling.
James H. Sears.
William H. Allen.
Walter McLean,
Charles C. Rogers.
Clifford J. Boush.
Stephen Jenkins.
John T. Newton.
Thomas G. Winch.
Lovell K. Reynolds.
William L. Varnum

ENGINEER DIVISION.

CADET PETTY-OFFICERS.

First Class.

William Cowles.
Frank H. Eldridge.
William R. King.

Second Class.

George S. Willits.
Walter F. Worthington.
Frank H. Bailey.

CADET-MIDSHIPMEN

AND

CADET-ENGINEERS ON PROBATION AT THE NAVAL ACADEMY,

WITH THEIR

RELATIVE STANDING

AS DETERMINED AT THE

ANNUAL EXAMINATION IN MAY, 1874;

TOGETHER WITH

THE GRADUATING CLASSES OF 1874.

MIDSHIPMEN.

Graduating Class—30 members.

Order of general merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit.										Number of Demerits.	Sea-service.	
				Years.	Months.	Seamanship.	Practical exercises in Seamanship.	Gunnery.	Fencing.	Steam.	Navigation.	Heat.	Light.	Law.	Spanish.		Months.	Days.
17	Allderdice, Winslow	Virginia	June 17, 1870	16		17	27	16	21	10	21	11	21	18	30	94	6	26
21	Arms, Lyman	Michigan	Sept. 24, 1870	16	10	7	14	15	3	16	26	20	17	15	14	141	6	26
26	Bowyer, John Marshall	Iowa	Sept. 28, 1870	17	3	4	2	19	19	12	28	12	24	8	17	21	6	26
12	Colwell, John Charles	At large	Sept. 22, 1870	14	1	18	10	13	27	11	16	10	26	17	16	131	6	26
30	Danner, Frederick William	Alabama	June 23, 1869	17	7	25	4	26	7	27	30	28	30	23	24	140	13	14
15	Dorn, Edward John	Missouri	Sept. 21, 1870	16	8	13	8	14	16	14	24	18	15	4	12	44	10	15
28	Emmons, George Thornton	At large	June 4, 1870	17	11	29	15	25	14	21	28	25	14	9	26	49	6	26
25	Farnsworth, John	Illinois	Sept. 25, 1869	14	0	26	28	29	15	30	15	23	11	29	19	122	11	15
2	**Fiske, Bradley Allen**	Ohio	Sept. 22, 1870	16	3	9	24	4	4	8	4	3	4	2	4	93	6	26
7	Flynne, Lucian	Texas	Sept. 22, 1870	15	10	12	24	2	11	4	1	4	2	5	1	98	6	26
16	Fuller, Edward Chapman	Ohio	Sept. 27, 1870	17	11	21	19	12	12	1	18	8	27	24	29	142	6	26
23	Haskell, Charles William	Iowa	June 23, 1870	16	10	27	18	10	21	25	25	19	28	13	26	84	6	26
3	**Holmes, Frank Huntington**	California	June 29, 1870	17	9	1	12	5	25	3	8	2	3	10	25	77	6	26
8	Hutchins, Hamilton	New Hampshire	June 23, 1870	15	6	6	5	18	25	7	6	13	10	21	5	140	6	26
18	Hutter, George Edward	Virginia	June 21, 1870	17	3	9	10	20	24	17	11	17	19	14	20	53	6	26
22	Milligan, Frank John	Tennessee	June 29, 1869	16	6	20	16	11	29	20	22	30	23	16	22	66	12	6
27	Nicolson, John Ormond	Alabama	June 29, 1869	16	4	22	30	28	30	29	27	29	15	25	14	89	12	6
9	Noell, York	Pennsylvania	Sept. 20, 1870	16	5	23	29	8	12	17	9	15	18	19	10	127	6	26
19	Nostrand, Warner Hatch	New York	Sept. 23, 1870	17	10	19	19	24	28	21	12	14	13	27	18	131	6	26
10	Parker, John Frederick	Ohio	Sept. 29, 1870	17	5	9	9	9	23	9	22	7	6	7	12	149	6	26
29	Peacock, David	New Jersey	Sept. 28, 1869	15	4	28	21	30	5	19	17	27	8	30	28	141	10	14

1	**Peters, George Henry**	Pennsylvania	June 23, 1870	15	9	2	6	1	2	2	2	1	1	1	2	10	6	26
6	Reich, Henry Frick	Pennsylvania	Sept. 27, 1870	17	10	15	17	7	10	5	10	6	20	3	6	12	6	26
24	Reynolds, Edwin Lewis	New Jersey	June 21, 1870	17	3	24	23	17	19	26	20	24	29	28	23	68	6	26
11	Reynolds, Matthew Givens	Missouri	Sept. 21, 1870	15	10	3	1	23	1	13	5	16	12	20	21	83	6	26
14	Rooney, William Reed Alexander	Pennsylvania	Sept. 28, 1870	16	8	30	26	22	7	23	13	9	7	12	8	99	6	26
20	Scott, Bernard Orme	Alabama	June 29, 1870	14	5	15	2	27	7	27	14	22	22	11	8	5	6	26
5	**Stewart, John William**	Indiana	Sept. 28, 1870	17	4	14	7	3	16	6	7	5	9	6	7	34	6	26
4	**Wegmann, Albert**	New York	Sept. 21, 1870	16	5	5	13	21	16	14	3	21	5	22	3	111	6	26
13	Whitfield, William Edmund	Arkansas	June 21, 1870	17	11	7	22	6	6	24	19	26	25	26	11	74	10	15

CADET-MIDSHIPMEN.

First Class—32 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit.														Sea-service.	
				Years.	Months.	Seamanship.	Practical exercises in Seamanship.	Naval Tactics.	Ship-building.	Gunnery.	Infantry Tactics.	Fencing.	Astronomy.	Electricity.	Applied Mathematics.	Mechanics.	French.	Drawing.	No. of Demerits.	Months.	Days.
2	Amsden, Charles Heath	Ohio	Sept. 20, 1871	17	11	3	4	17	1	6	5	4	13	1	5	7	4	10	120	6	26
26	Beatty, Frank Edmund	Minnesota	Sept. 21, 1871	17	9	34	19	22	37	29	36	29	10	20	13	18	31	32	148	6	26
20	Bostick, Edward Dorsey	South Carolina	Sept. 24, 1870	17	1	5	14	15	15	24	19	37	19	27	31	33	18	16	132	10	4
28	Caperton, William Banks	Tennessee	June 5, 1871	15	11	35	37	16	29	31	33	7	31	25	20	22	22	16	19	6	26
14	Carter, Fydelio Sharps	Illinois	Sept. 29, 1870	17	4	8	7	29	3	10	21	8	37	21	19	19	7	14	111	10	4
13	Coffin, Frederick Wesley	Massachusetts	June 15, 1870	17	9	19	21	18	32	7	16	11	6	18	8	15	5	34	140	6	26
31	Collins, Frank Sheldon	At large	Sept. 25, 1871	17	2	36	36	31	13	16	21	10	28	26	33	26	27	27	186	6	26
10	Corbin, Clarence Arthur	Michigan	Sept. 26, 1870	17	2	9	9	30	17	25	3	24	17	9	11	9	12	24	186	10	4
9	Cutler, William Gifford	At large	Sept. 20, 1871	16	11	22	14	27	19	19	14	20	7	13	3	11	6	22	89	6	26
23	Daniels, David	Massachusetts	June 5, 1871	15	4	23	21	24	18	20	26	18	35	11	24	27	19	29	87	6	26
22	Doyle, Robert Morris	Tennessee	Sept. 21, 1870	16	4	20	31	28	30	28	22	33	22	18	14	16	34	20	100	10	4
6	Fletcher, Frank Friday	Iowa	Sept. 22, 1870	14	10	11	14	6	26	15	30	9	2	6	2	3	19	4	99	10	4
12	Helm, James Meredith	Tennessee	Sept. 29, 1871	15	9	1	14	11	28	21	17	2	10	30	6	10	26	36	130	6	26
15	Hodges, Harry Marsh	Illinois	Sept. 29, 1870	15	3	18	11	19	16	18	35	30	3	15	16	12	22	12	87	6	26
1	Hodgson, Albon Charles	Georgia	June 5, 1871	17	10	4	2	2	2	1	1	23	1	2	1	1	1	36	137	6	26
8	Hosley, Harry Hibbard	New Hampshire	Sept. 22, 1871	15	10	14	21	13	22	23	2	25	24	3	12	8	2	26	163	6	26
21	Howe, Alfred Leighton	Pennsylvania	Sept. 28, 1870	16	5	14	32	11	27	11	13	32	32	21	34	30	14	1	120	10	4
4	Hughes, Walter Scott	Iowa	Sept. 24, 1870	17	11	7	21	3	6	14	15	22	4	5	7	11	11	8	0	6	26
24	Hunt, Henry Jackson	At large	June 23, 1870	15	2	24	4	25	14	33	32	4	20	17	27	27	37	3	195	10	4
32	Hunt, Ridgley	Louisiana	Sept. 20, 1870	16	7	26	9	35	25	36	34	36	31	31	30	21	33	11	146	10	4
5	Laird, Charles	Ohio	Sept. 28, 1870	16	7	2	21	1	4	4	8	31	12	8	10	6	25	5	134	6	26

29	McCartney, Charles Michael	Pennsylvania ...	Sept. 23, 1869	15	1	30	34	35	35	34	37	33	25	36	35	29	3	9	125	6	26
17	Sharp, Alexander, jr	Dist. of Columbia	June 20, 1870	14	7	11	6	13	11	5	12	15	15	35	21	25	34	18	123	10	4
16	Shearman, John Adams....	New York	June 7, 1871	16	10	11	11	8	36	27	27	21	8	21	15	13	21	20	185	6	26
25	Smith, James Thomas.....	North Carolina..	June 5, 1871	16	3	32	32	34	31	17	31	35	20	23	28	31	8	28	25	6	26
30	Stoney, George.....	Alabama.....	Sept. 20, 1870	17	11	26	19	33	34	32	25	28	29	37	23	21	36	22	149	6	26
18	Townley, Richard Henry ..	Nebraska	June 20, 1870	17	4	21	7	7	9	9	4	4	23	16	22	23	29	34	183	6	26
7	Usher, Nathaniel Reilley...	Indiana	Sept. 21, 1871	16	5	17	21	5	8	3	11	12	14	10	17	5	17	14	185	6	26
27	Vinton, Frederick Betts ...	New York.....	Sept. 29, 1871	16	9	28	29	26	24	30	29	26	18	28	32	17	14	33	132	6	26
3	Winslow, Cameron McRae.	At large.....	Sept. 27, 1870	16	1	6	1	4	7	12	6	1	5	4	4	2	12	2	133	6	26
11	Wood, Moses Lindley.....	Missouri	Sept. 21, 1871	17	1	24	21	8	33	8	28	3	16	14	9	4	22	7	73	6	26
19	Worcester, George Henry..	New York.....	Sept. 26, 1871	14	3	29	28	8	10	2	18	27	9	6	18	20	29	29	198	6	26
‡	Jardine, Augustus Edward.	At large.....	Sept. 21, 1870	15	8	16	35	20	20	26	20	16	27	34	24	35	16	29	13	10	4

‡ *Turned back to second class.*

CADET-MIDSHIPMEN.

Second Class—48 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit.										Number of Demerits.	Sea-service.	
				Years.	Months.	Seamanship.	Ordnance Instructions.	Mechanical Drawing.	Mathematics.	Chemistry.	History.	Rhetoric.	French.	Drawing.	Fencing.		Years.	Months.
7	Allen, William Herschell	Illinois	Sept. 26, 1872	15	10	10	15	52	3	2	22	6	17	38	22	139	3	18
11	Boush, Clifford Joseph	Virginia	June 5, 1872	17	9	5	4	16	16	13	23	22	12	8	12	83	3	18
1	Brown, Stimson Joseph	New York	Sept. 16, 1872	17	11	4	8	44	2	5	3	5	1	5	3	231	3	18
22	Braunersreuther, William	Illinois	Sept. 23, 1871	17	7	15	10	40	20	10	44	36	33	37	6	91	3	18
40	Chambers, Washington Irving	New York	June 5, 1871	15	2	34	37	8	37	51	49	51	17	11	1	182	8	27
31	Coffman, De Witt	Virginia	June 6, 1872	17	6	22	16	44	39	40	34	47	25	30	8	10	3	18
18	Culver, Abraham Ellis	New York	June 5, 1872	16	2	34	57	40	19	20	12	11	10	18	36	134	6	9
29	Case, Daniel Rogers	At large	June 5, 1872	15	0	22	41	29	27	27	27	25	45	44	19	279	6	9
43	Fisher, Elstner Nelson	Pennsylvania	Sept. 21, 1872	17	11	53	53	20	44	12	40	46	44	20	15	246	3	18
9	Foulk, George Clayton	Pennsylvania	June 14, 1872	15	7	3	12	16	14	11	5	7	16	9	25	151	6	9
2	Gearing, Henry Chalfant	Pennsylvania	June 12, 1872	17	3	14	11	40	1	4	2	9	6	19	28	238	6	9
20	Gillmore, James Clarkson	Pennsylvania	Sept. 20, 1871	17	2	20	13	1	26	21	37	24	28	2	38	115	6	6
24	Gove, Charles Augustus	New Hampshire	June 5, 1871	16	11	18	26	6	24	23	30	34	40	32	36	215	6	6
44	Grabo, Hermann Francis	New Jersey	Sept. 22, 1871	16	0	48	55	24	45	49	55	41	31	14	38	103	3	18
41	Griffin, Thomas Dillard	Virginia	Sept. 20, 1872	17	9	50	44	52	37	47	36	31	11	48	40	203	3	18
39	Hall, Alfred Lovell	Ohio	Sept. 16, 1872	17	11	17	20	18	41	25	46	49	42	45	22	40	8	27
30	Hannum, William Gangwere	Pennsylvania	Sept. 23, 1872	16	1	27	38	21	29	41	20	27	31	42	19	233	6	9
25	Henderson, Richard	North Carolina	Sept. 28, 1872	17	1	31	48	32	20	17	39	39	33	15	33	215	3	8
32	Hogg, William Stetson	At large	Sept. 24, 1872	15	10	28	44	10	25	38	42	41	41	34	7	77	3	18
§	Jardine, Augustus Edward	At large	Sept. 21, 1870	15	8	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	10	4
12	Jenkins, Stephen	New York	Sept. 20, 1871	14	2	11	39	5	13	19	6	2	5	11	1	156	6	6
37	Johnson, Henry Albert	At large	June 5, 1872	17	0	31	42	2	29	48	52	30	39	1	10	235	3	18

5	Katz, Edward Marc	Wisconsin	June 8, 1872	16	7	13	14	12	10	1	4	13	8	7	12	230	3	81
46	Katz, Koroku	Empire of Japan	June 7, 1871	16	4	52	50	24	46	53	51	52	(a)	41	54	154	3	18
45	Kunitomo, Giro	Empire of Japan	Oct. 7, 1872	17	1	45	47	49	42	54	43	54	(a)	50	52	87	3	18
35	Mallory, Stevenson Blount	Virginia	June 12, 1872	16	0	44	33	49	29	37	29	19	35	43	43	182	6	9
21	Mayo, Henry Thomas	Vermont	June 13, 1872	15	6	15	7	49	20	39	19	23	26	16	45	240	3	18
8	McLean, Walter	At large	June 6, 1872	16	10	9	2	47	9	7	1	1	39	36	49	113	3	18
34	Minett, Henry	Kentucky	June 8, 1872	15	9	34	32	36	29	31	28	35	42	21	15	247	3	18
42	Mulligan, Richard Thomas	New Jersey	June 5, 1871	15	0	46	24	27	35	30	35	47	49	10	34	169	8	27
13	Newton, John Thomas	At large	Oct. 14, 1872	17	0	22	19	28	12	16	15	16	2	32	19	173	3	18
33	Piepmeyer, Louis William	At large	Sept. 22, 1871	17	0	43	23	39	47	46	11	4	14	23	22	169	6	6
19	Pond, Charles Fremont	Connecticut	June 12, 1872	15	7	34	28	14	17	32	9	12	23	13	48	243	6	9
6	Potts, Templin Morris	At large	June 6, 1872	16	7	8	1	32	5	15	10	14	7	45	49	249	3	18
26	Proudfit, John McLean	At large	Sept. 24, 1872	17	5	30	25	14	28	43	41	40	21	27	29	220	3	18
23	Ray, Robert Clary	At large	Oct. 1, 1872	17	11	39	21	21	18	35	16	37	19	45	45	96	3	18
15	Reynolds, Lovell Knowles	Alabama	June 5, 1871	14	4	2	9	26	20	22	18	21	29	27	14	230	6	6
10	Rogers, Charles Custis	Tennessee	June 7, 1872	16	0	38	18	37	4	18	8	3	3	16	11	85	3	18
17	Rollins, Anthony Wayne	Kentucky	June 10, 1872	17	3	19	30	43	8	44	26	26	26	22	53	179	6	9
27	Rose, William Darcy	At large	June 5, 1872	15	11	28	31	35	33	26	24	32	37	26	(a)	90	3	18
4	Sears, James Hamilton	New York	Sept. 20, 1871	16	8	6	6	31	5	9	2	10	12	3	9	238	6	6
28	Sherman, Francis Howland	Missouri	Sept. 20, 1871	16	5	33	29	4	34	29	25	29	37	27	32	98	8	27
36	Tappan, Benjamin	Arkansas	Sept. 21, 1871	15	5	42	22	29	42	34	33	15	21	50	15	176	6	6
16	Varnum, William Lahy	Pennsylvania	June 5, 1871	16	6	1	5	21	14	28	14	45	45	35	4	84	8	27
3	Walling, Burns Tracy	Ohio	June 5, 1872	17	4	12	3	32	5	3	7	8	8	38	47	191	3	18
14	Winch, Thomas Garfield	Ohio	Sept. 20, 1872	17	10	20	17	3	11	6	13	17	48	6	4	210	3	18
38	Wise, Edward Everett	At large	June 5, 1871	16	6	47	36	13	35	33	48	37	23	3	51	201	6	6
†	Wood, Thomas Newton	At large	June 6, 1871	16	7	41	35	11	54	45	31	50	50	30	41	228	6	6
‡	Horton, Cyrus William	New York	June 12, 1872	16	11	39	43	19	51	24	45	44	35	53	31	322	3	18
‡	Macomb, Augustus Canfield	Kentucky	Sept. 24, 1872	17	11	26	26	8	39	8	32	18	15	38	47	344	3	18
‡	Poland, Edward Rowell	Vermont	Sept. 21, 1871	16	6	(a)	46	56	(a)	(a)	53	(a)	19	(a)	(a)	114	6	6

† *Deficient.* ‡ *Turned back to third class.* § *Turned back from first class.*

CADET-MIDSHIPMEN]

Third Class—64 members.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit.						
				Years.	Months.	Mathematics.	Grammar.	History.	French.	No. of Demerits.	Sea-service. Months.	Sea-service. Days.
36	Benson, William Shepherd	Georgia	Sept. 21, 1872	16	11	39	27	40	38	74	3	8
10	Bostwick, Frank Matteson	Wisconsin	Sept. 26, 1873	16	5	16	11	16	12	149	3	8
37	Brice, Jonathan Kearsley	Ohio	June 13, 1873	17	8	35	26	51	54	246	3	8
6	Bronaugh, William Venable	Kentucky	June 5, 1873	17	9	4	12	8	32	183	3	8
30	Brumby, Thomas Mason	Georgia	Sept. 26, 1873	17	10	33	25	21	46	58	3	8
42	Buckley, Frank Seldon	Michigan	Sept. 26, 1873	15	11	44	32	54	66	80	3	8
49	Burdick, William Leslie	Ohio	Sept. 26, 1873	16	9	52	44	42	52	109	3	8
40	Case, Frank Blair	Michigan	June 7, 1873	15	7	26	57	68	76	195	3	8
60	Castle, Mark Cheney	Minnesota	Sept. 29, 1873	16	9	50	51	72	74	284	3	8
55	Cook, Simon	Missouri	June 6, 1873	16	11	39	67	78	54	10	3	8
34	Constant, Walter Maibee	Indiana	June 13, 1873	16	3	36	34	29	44	60	3	8
14	David, William Glenn	New York	Sept. 25, 1873	17	2	18	9	19	38	124	3	8
52	Denfeld, George William	Massachusetts	Sept. 26, 1873	17	1	46	55	55	57	110	3	8
18	Dodd, Arthur Wright	Indiana	June 6, 1873	16	10	16	18	57	28	63	3	8
15	Dodge, Omenzo George	Kansas	June 13, 1873	17	0	12	31	22	48	22	3	8
33	Dombaugh, Harry Mason	Ohio	June 6, 1872	16	4	19	52	59	62	172	3	8
48	Dunn, Herbert Omar	Rhode Island	June 6, 1873	16	0	54	36	33	61	55	3	8
61	Dykeman, John Henry	Iowa	June 5, 1873	17	5	61	75	66	70	156	3	8
53	Endress, William Fries	New York	Sept 25, 1873	17	1	57	33	34	65	22	3	8
4	Fechteler, Augustus Francis	At large	June 5, 1873	15	0	2	14	13	5	245	3	8
56	Fletcher, Lewis Cass	Pennsylvania	June 14, 1873	16	1	45	72	63	44	157	3	8
43	Frenzel, Arthur Benjamin	Massachusetts	June 7, 1872	17	7	42	70	58	12	312	3	8
1	Fullam, William Freeland	New York	Sept. 24, 1873	17	11	3	2	1	11	9	3	8

22	Gleaves, Albert	Tennessee	June 10, 1873	15	5	23	15	20	54	177	3	8
32	Grant, Albert Weston	Wisconsin	June 9, 1873	17	1	21	59	49	57	109	3	8
28	Green, William	Texas	June 13, 1873	16	11	41	17	12	8	49	3	8
38	Harrison, Horace Willford	At large	Sept. 24, 1872	16	9	52	22	27	3	295	3	8
46	Heath, Frank Rives	At large	Sept. 23, 1873	16	4	50	58	52	16	48	3	8
27	Hodges, Fletcher	Georgia	June 5, 1872	16	8	29	29	23	22	211	3	8
19	Hodges, Benjamin Ward	Mississippi	Sept. 23, 1873	17	5	32	6	9	32	46	3	8
§	Horton, Cyrus William	New York	June 12, 1872	16	11	-----	-----	-----	-----	-----	3	18
20	Jeffries, Alfred	Texas	June 9, 1873	17	9	22	37	25	36	14	3	8
23	Jones, David Warren	Ohio	June 8, 1872	16	7	20	48	36	8	246	3	8
13	Jones, Henry Champion	Maine	Sept. 26, 1873	17	1	29	1	4	10	10	3	8
11	Jordan, John Newell	Maine	June 5, 1873	17	8	11	23	14	57	137	3	8
51	Lansdale, Philip Van Horne	At large	June 6, 1873	15	3	47	60	46	68	0	3	8
35	Machida, Keizero	Empire of Japan	Oct. 14, 1873	16	4	14	73	64	77	245	3	8
§	Macomb, Augustus Canfield	Kentucky	Sept. 24, 1872	17	11	-----	-----	-----	-----	-----	3	18
54	Maynadier, Thomas Barker	At large	June 10, 1872	16	9	48	71	53	18	313	3	8
47	McNasser, John Henry	Wyoming	June 8, 1872	15	0	49	66	48	22	170	3	8
16	Messenger, Lyman Bernardo	Massachusetts	Sept. 26, 1872	16	7	12	30	41	6	260	3	8
8	Nelson, Valentine Sevier	Tennessee	June 6, 1873	17	5	9	19	7	35	24	3	8
5	Oliver, James Harrison	Georgia	June 12, 1873	16	0	7	16	11	4	97	3	8
9	Orchard, John Madison	Missouri	June 11, 1873	15	9	5	13	32	34	251	3	8
7	Ormsby, George Francis	Ohio	Sept. 24, 1873	17	4	10	10	3	29	56	3	8
24	Osterhout, William Bigler	Pennsylvania	June 12, 1872	17	8	15	64	35	24	275	3	8
39	Paris, Russel Clark	New York	Sept. 23, 1873	14	1	31	46	84	30	52	3	8
26	Parker, James Philip	North Carolina	June 6, 1873	17	8	38	5	15	24	22	3	8
§	Poland, Edward Rowell	Vermont	Sept. 21, 1871	16	6	-----	-----	-----	-----	-----	6	6
50	Rogers, Henry Horace	Illinois	June 13, 1873	17	9	58	20	43	50	41	3	8
45	Rush, William Rees	Louisiana	June 6, 1872	14	8	36	69	70	38	300	3	8
44	Schoolcraft, Oliver Johnson	Virginia	June 5, 1873	17	10	60	35	31	13	120	3	8
31	Sheeks, James David	Texas	Sept. 24, 1872	15	0	23	53	47	18	302	3	8
29	Taylor, Hiero	Illinois	Sept. 29, 1873	17	0	25	24	50	38	152	3	8
59	Toppan, Frank Winship	Massachusetts	Sept. 22, 1873	17	9	54	56	65	60	54	3	8
57	Wakenshaw, Harry Charles	New Jersey	June 10, 1873	16	6	63	38	30	46	55	3	8
41	Werlich, Percival Julius	Wisconsin	June 16, 1873	16	4	42	45	26	75	190	3	8
12	Williams, Charles Sumner	Wisconsin	June 12, 1873	16	9	8	39	18	43	255	3	8

CADET-MIDSHIPMEN.

Third Class—64 *members*—Continued.

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit.					Sea-service.	
				Years.	Months.	Mathematics.	Grammar.	History.	French.	No. of demerits.	Months.	Days.
58	Wilson, John Cochran, jr	New York	Sept. 25, 1873	16	3	54	54	71	27	291	3	8
3	Winterhalter, Albert Gustavus	Michigan	Sept. 22, 1873	16	11	6	4	10	2	41	3	8
2	Witzel, Horace Mark	Wisconsin	June 5, 1873	15	4	1	3	5	18	66	3	8
25	Wood, Albert Norton	Indiana	Sept. 24, 1873	16	6	26	21	17	49	246	3	8
21	Woodworth, Selim Edward	At large	Sept. 30, 1872	15	5	26	28	24	1	280	3	8
17	Wright, Edward Everett	Massachusetts	Sept. 20, 1873	17	0	34	7	5	16	27	3	8
‡	Atwater, Charles Nelson	New York	Sept. 24, 1873	16	3	65	40	37	67	66	3	8
‡	Blodgett, Spencer Langdon	Pennsylvania	Sept. 26, 1873	15	4	75	80	82	88	94	3	8
‡	Canfield, William Chase	At large	Sept. 23, 1873	16	1	70	42	28	50	69	3	8
‡	Carrington, Austin Downs	Virginia	Sept. 23, 1873	17	5	69	50	56	36	187	3	8
‡	Dent, Baine Caruthers	At large	June 5, 1873	16	7	(a)	(a)	(a)	(a)	308	3	8
‡	Fauntleroy, Robert Powell	At large	Sept. 23, 1873	16	5	77	47	69	42	194	3	8
‡	Hall, William Edward Wyatt	Maryland	June 14, 1873	17	3	72	78	83	64	276	3	8
‡	Hess, George Henry	Michigan	Sept. 23, 1873	17	7	71	74	44	71	186	3	8
‡	Mason, John Green	Ohio	June 5, 1873	17	6	73	83	85	91	180	3	8
‡	Purcell, John Lewis	New Jersey	Sept. 29, 1873	17	4	80	81	76	86	35	3	8
‡	Ryan, Thomas William	Pennsylvania	June 13, 1873	16	11	64	49	39	13	151	3	8
‡	Taylor, Bushrod Wilber	At large	Sept 20, 1873	14	7	91	97	(a)	89	27	3	8
‡	Tracy, Arthur Barton	New York	June 5, 1873	16	10	68	43	30	6	44	3	8
‡	Todd, Wilson Lemuel	Pennsylvania	June 5, 1873	15	1	76	84	89	79	245	3	8
‡	Wright, Robert Kemp	Pennsylvania	June 10, 1873	14	8	74	65	61	53	217	3	8

§ *Turned back from second class.*

‡ *Turned back to fourth class.*

CADET-MIDSHIPMEN.

Fourth Class—103 *members.*

Name.	State.	Date of admission.	Age at date of admission.	
			Y'rs.	Mo's.
Arima, Kantaro	Empire of Japan	June 4, 1874	17	3
Atwater, Charles Nelson	New York	Sept. 24, 1873	16	3
Bailey, Prentice	Kentucky	Sept. 28, 1874	17	1
Baker, Henry Edwin, jr	Mississippi	Sept. 24, 1874	17	0
Barnard, Louis Hull	Colorado	June 13, 1874	16	11
Bartlett, David L	Missouri	Sept. 24, 1874	15	5
Beale, Joseph	Pennsylvania	Oct. 12, 1874	14	10
Bell, John Arthur	West Virginia	June 13, 1874	16	11
Belmont, Oliver Hazard Perry	New York	Sept. 30, 1874	14	10
Bibb, Payton Benajah	Alabama	June 12, 1874	17	3
Biddle, Spencer Fullerton Baird	At large	June 13, 1874	15	5
Blodgett, Spencer Langdon	Pennsylvania	Sept. 26, 1873	15	4
Boon, Howard County	Missouri	June 12, 1874	17	4
Boyd, John Platt	New York	Sept. 26, 1874	17	1
Breck, Charles Renwick	California	Oct. 21, 1874	16	0
Cahoon, James Blake	Vermont	June 10, 1874	17	6
Canfield, William Chase	At large	Sept. 23, 1873	16	1
Carrington, Austin Downs	Virginia	Sept. 23, 1873	17	5
Clark, George Ramsey	Ohio	June 9, 1874	17	3
Conger, Pliny Oliver	New York	June 13, 1874	14	9
Cox, William Henry	Tennessee	Sept. 26, 1874	17	11
Cramer, Ambrose	Maryland	Sept. 28, 1874	17	6
Craven, John Eccleston	New Jersey	Sept. 24, 1874	15	10
Crosby, William	Texas	Sept. 25, 1874	16	11
Cummings, Le Roy Edmund	Dakota	Sept. 24, 1874	17	4
Cunningham, Andrew Charles	New York	June 9, 1874	16	4
Dent, Baine Caruthers	At large	June 5, 1873	16	7
Dickinson, Thomas	Kentucky	Sept. 24, 1874	16	5
Dougherty, John Allen	Missouri	June 12, 1874	16	9
Drayton, Percival Langdon	New York	June 10, 1874	16	2
Duer, Francis Hoyt	New Jersey	May 16, 1874	18	0
Fauntleroy, Robert Powell	At large	Sept. 23, 1873	16	5
Fillmore, John Hudson	Illinois	Sept. 24, 1874	17	10
Fitzgerald, Edward Daniel	Maryland	Oct. 2, 1874	15	11
Garrett, Charles Warren	Indiana	June 5, 1874	17	10
Gibson, John	Kentucky	Feb. 16, 1874	18	0
Glennon, James Henry	California	Sept. 24, 1874	17	7
Graham, William Alfred	New York	Sept. 28, 1874	14	11
Gray, Alfred Giliat	Illinois	Sept. 26, 1874	15	11
Gray, James	Illinois	Sept. 24, 1874	15	8
Guinnip, Arthur Benjamin	Illinois	Sept. 28, 1874	16	7
Hall, William Edward Wyatt	Maryland	June 14, 1873	17	3
Hess, George Henry	Michigan	Sept. 23, 1873	17	7
Hetherington, James Henry	Iowa	June 9, 1874	17	7
Holcombe, John Hite Lee	At large	June 27, 1874	17	9
Hood, John	Alabama	June 12, 1874	14	6
Hooke, Horatio Hill	Illinois	Sept. 26, 1874	17	0
Hughes, Richard Morris	Pennsylvania	Sept. 25, 1874	15	8
Huse, Harry McLaren Pinkney	New York	Sept. 30, 1874	15	10
Jungen, Charles William	Wisconsin	Sept. 24, 1874	15	6
Kimmell, Harry	Pennsylvania	Sept. 28, 1874	14	5
Knapp, Harry Shepard	Connecticut	June 26, 1874	18	0

CADET-MIDSHIPMEN—Continued.

Fourth Class—103 *members*—Continued.

Name.	State.	Date of admission.	Age at date of admission.	
			Y'rs.	Mo's.
Knapp, John Joseph	Missouri	June 9, 1874	16	8
Lopez, Robert Files	Tennessee	Sept. 29, 1874	17	6
Lloyd, Edward, jr	Maryland	June 17, 1874	16	11
Mason, John Greene	Ohio	June 5, 1873	17	6
Maury, Alfred Ingraham	Mississippi	Sept. 28, 1874	15	11
Maxwell, William John	At large	June 9, 1874	15	2
Mayer, Chester Alfred	New York	June 16, 1874	17	5
McDonnell, John Edmund	Nevada	Sept. 30, 1874	16	4
Meares, Frederick Parkhouse	North Carolina	Sept. 25, 1874	16	3
Melton, Lawson	South Carolina	Sept. 25, 1874	16	3
Menefee, Daniel Preston	California	Sept. 25, 1874	16	6
Morey, Alfred George	Louisiana	Sept. 25, 1874	16	11
Namboo, Heidemaro	Empire of Japan	June 5, 1874	16	1
Paxton, Alfred Noble	Ohio	Sept. 24, 1874	17	4
Perry, George Ernest	Illinois	June 10, 1874	14	7
Perry, John Adams	Nebraska	Sept. 29, 1874	15	1
Picking, William Webster	Pennsylvania	Sept. 24, 1874	16	11
Poundstone, Homer Clarke	West Virginia	Sept. 24, 1874	14	0
Preble, George Henry Rittenhouse	At large	Sept. 28, 1874	15	2
Purcell, John Lewis	New Jersey	Sept. 29, 1873	17	4
Quimby, John Gardner	At large	June 12, 1874	14	10
Read, Maurice Lance	South Carolina	Sept. 28, 1874	15	10
Redfern, Joseph Louis	At large	July 13, 1874	17	11
Richardson, Samuel	Mississippi	June 17, 1874	16	1
Rodgers, Thomas Slidell	District of Columbia	Sept. 24, 1874	16	1
Rodgers, William Ledyard	California	June 11, 1874	14	4
Rogers, Allen Grey	North Carolina	June 12, 1874	14	6
Rowan, Andrew Summers	West Virginia	Sept. 25, 1874	17	5
Ryan, Thomas William	Pennsylvania	June 13, 1873	16	11
Schwerin, Rennie Pierre	New York	Sept. 25, 1874	16	1
Shipley, John Harry	Missouri	Sept. 30, 1874	16	6
Skinner, Frank Colby	Massachusetts	Sept. 26, 1874	17	6
Smith, Roy Campbell	Virginia	Oct. 3, 1874	16	2
Sparhawk, George	Massachusetts	Sept. 24, 1874	17	6
Sprague, Frank Julian	Massachusetts	Sept. 29, 1874	17	2
Stafford, George Henry	Iowa	June 10, 1874	17	11
Sturdevant, Harry Leland	Maine	June 13, 1874	17	8
Swift, Franklin	Massachusetts	June 9, 1874	16	1
Taylor, Bushrod Wilber	At large	Sept. 20, 1873	14	7
Tillman, Edwin Hord	Tennessee	Sept. 28, 1874	15	11
Todd, William Lemuel	Pennsylvania	June 5, 1873	15	1
Tracy, Arthur Barton	New York	Jane 5, 1873	16	10
Van Horn, George	New York	June 9, 1874	17	6
Wallace, Carshena	Washington	May 15, 1874	18	0
Webb, Lovell Hastings	Kansas	Sept. 28, 1874	17	7
Webster, Edwin Belden	Connecticut	Sept. 28, 1874	16	6
Welsh, George Silvis	Pennsylvania	Sept. 24, 1874	17	7
White, William Porter	At large	June 30, 1874	15	5
Wilson, Llewellyn Victor	District of Columbia	Sept. 25, 1874	17	0
Wright, Robert Kemp	Pennsylvania	June 12, 1873	14	8
Young, Feramorz Little	Utah	Sept. 24, 1874	16	0

CADET-ENGINEERS.

Graduating Class—10 *members.*

Order of general merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit.								Sea-service.	
				Years.	Months.	Electricity.	Chemistry.	Statics.	French.	Applied mathematics and mechanics.	Heat.	Steam.	Conduct.	Months.	Days.
5	Canaga, Alfred Bruce	Ohio	Oct. 1, 1872	21	9	7	3	2	5	4	9	11	1	2	26
3	Eaton, William Colgate	N. Y.	Oct. 1, 1872	21	7	6	1	3	3	2	2	10	5	2	26
7	Edwards, John Richard	Pa	Oct. 1, 1871	18	2	8	8	5	7	7	5	8	3	6	2
4	Hoffman, Frank Jacob	Md	Oct. 1, 1872	19	11	2	4	4	1	3	6	6	8	2	26
1	Mattice, Asa	N. Y.	Oct. 1, 1872	19	2	1	1	1	4	1	1	1	1	2	26
10	Potts, Stacy	Pa	Oct 1, 1871	18	7	4	11	6	11	5	8	2	14	6	2
2	Ransom, George Brinkerhoff.	N. Y.	Oct. 1, 1871	20	3	5	6	7	6	8	10	5	11	6	2
8	Warren, Benjamin Howard	Mass.	Oct. 1, 1871	21	7	10	5	12	9	12	7	3	10	6	2
9	Willitts, Albert Bowen	Pa	Oct. 1, 1872	21	6	3	9	8	13	6	4	7	3	2	26
6	Zane, Abram Varhoy	Pa	Oct. 1, 1871	21	1	11	12	9	8	9	3	4	13	6	2
‡	Boggs, William Brenton	D. C	Oct. 1, 1871	19	11	14	13	14	2	14	12	12	9	6	2
‡	Eldridge, Frank Harold	Ohio	Oct. 1, 1872	20	2	13	10	11	14	13	11	13	7	2	26
‡	Kleckner, Charles	Pa	Oct. 1, 1871	18	7	9	7	13	12	10	14	9	5	6	2
‡	Warburton, Edgar Townsend	Pa	Oct. 1, 1872	17	3	12	14	10	10	11	13	14	12	2	26

‡ *Turned back to first class.*

CADET-ENGINEERS.

First Class—16 *members.*

Order of annual merit.	Name.	State.	Date of admission.	Age at date of admission.		Order of merit.			No. of demerits.	Sea-service.	
				Years.	Months.	Mathematics.	Steam.	French.		Months.	Days.
12	Babbitt, Henry Thomas	Ohio	Oct. 1, 1873	17	2	12	14	9	154	3	9
2	Bailey, Frank Hughes	Pa	Oct. 1, 1873	22	3	1	1	19	15	3	9
§	Boggs, William Brenton	D. C	Oct. 1, 1871	19	11	.....	....	....	.....	6	2
10	Burgdorff, Theodore Frederick	N. J	Oct. 1, 1873	18	9	10	8	5	0	3	9
5	Cathcart, William Ledyard	Conn	Oct. 1, 1873	18	1	7	2	7	20	3	9
4	Cowles, William	N. Y.	Oct. 1, 1873	18	7	4	3	9	28	3	9
8	De Ruiz, Alberto	Pa	Oct. 1, 1873	20	5	9	7	1	160	3	9
§	Eldridge, Frank Harold	Ohio	Oct. 1, 1872	20	2	.....	....	....	.....	2	26
7	Freeman, Edward Russell	Miss	Oct. 1, 1873	19	9	5	12	6	43	3	9
1	King, William Richard	Md	Oct. 1, 1872	19	9	2	5	4	125	6	5
§	Kleckner, Charles	Pa	Oct. 1, 1871	18	7	.....	....	....	.....	6	2
6	Little, William Nelson, jr	Ga	Oct. 1, 1872	19	8	6	4	8	142	6	5
11	Loomis, Edmund Underwood	Md	Oct. 1, 1872	21	3	13	10	14	20	3	9
3	Willits, George Sidney	Pa	Oct. 1, 1873	20	6	3	9	3	31	3	8
§	Warburton, Edgar Townsend	Pa	Oct. 1, 1872	17	3	.....	....	....	.....	2	26
9	Worthington, Walter Fitzhugh	Md	Oct. 1, 1873	18	6	8	11	2	42	3	9
‡	Dunning, William Batey	N. Y.	Oct. 1, 1873	19	2	14	13	15	86	3	9
‡	Reid, Robert Ingersoll	Pa	Oct. 1, 1872	20	2	15	17	13	113	3	9
‡	Stivers, Henry Hicks	N. Y.	Oct. 1, 1873	18	0	17	5	16	79	3	9

‡ *Turned back and forming the second class.* § *Turned back from the graduating class.*

CADET-ENGINEERS.

Fourth Class—27 members.

Name.	State.	Date of admission.	Age at date of admission.		Relative standing as determined at examination for appointment.
			Years.	Months.	
Bartlett, Frank W	Michigan	Oct. 1, 1874	18	1	10
Bennett, Frank M	Michigan	Oct. 1, 1874	17	5	26
Bieg, Frederick Charles	Missouri	Oct. 1, 1874	18	6	11
Bull, Goold Hoyt	Pennsylvania	Oct. 1, 1874	18	4	17
Burd, George Eli	Massachusetts	Oct. 1, 1874	17	5	14
Claude, Gordon Handy	Maryland	Oct. 1, 1874	20	0	13
Cooley, Mortimer Elwyn	New York	Oct. 1, 1874	19	6	7
Crygier, John Ulysses	New York	Oct. 1, 1874	16	6	16
Dungan, Horace Greeley	Iowa	Oct. 1, 1874	20	6	19
Elseffer, Harry Smith	Iowa	Oct. 1, 1874	19	3	22
Gage, Howard	Michigan	Oct. 1, 1874	18	1	8
Gow, John London	Indiana	Oct. 1, 1874	18	4	9
Griffin, Robert Stanislaus	Virginia	Oct. 1, 1874	17	0	12
Harrison, Henry Fillmore	Maryland	Oct. 1, 1874	18	9	20
Hogan, Thomas Joseph	Georgia	Oct. 1, 1874	18	10	5
Hollis, Ira Nelson	Kentucky	Oct. 1, 1874	18	6	1
Ivers, Henry King	Missouri	Oct. 1, 1874	18	6	24
McElroy, George Wightman	Michigan	Oct. 1, 1874	16	6	21
Norton, Harold Percival	New York	Oct. 1, 1874	18	10	25
O'Connor, Henry	District of Columbia	Oct. 1, 1874	19	3	27
Pickrell, Joseph McCall	Virginia	Oct. 1, 1874	17	2	4
Salisbury, George Robert	Missouri	Oct. 1, 1874	19	7	23
Schell, Franklin Jacob	Pennsylvania	Oct. 1, 1874	17	1	3
Scribner, Edward Herschell	Massachusetts	Oct. 1, 1874	19	11	18
Spangler, Harry Wilson	Pennsylvania	Oct. 1, 1874	16	9	6
Wight, Charles Leslie	Massachusetts	Oct. 1, 1874	21	1	2
Wilmer, Joseph Ringgold	Maryland	Oct. 1, 1874	20	10	15

SUMMARY.

Academic Year, 1874–75.

CADET-MIDSHIPMEN.

First Class	32 members.	
Second Class	48 members.	
Third Class	64 members.	
Fourth Class	103 members.	
		247

CADET-ENGINEERS.

First Class	16 members.	
Second Class	3 members.	
Fourth Class	27 members.	
		46
Total		293

Students from the Empire of Japan are received for instruction under a resolution of the Senate and House of Representatives of the United States, approved July 27, 1868.

RESIGNATIONS AND DISMISSALS.

RESIGNATIONS.

Cadet-Midshipman E. H. Gaither	Oct. 30, 1873.
Cadet-Engineer B. F. Kelley	Oct. 30, 1873.
Cadet-Engineer J. M. White	Oct. 30, 1873.
Cadet-Midshipman E. D. Leach	Nov. 5, 1873.
Cadet-Midshipman J. H. Conyers	Nov. 11, 1873.
Cadet-Midshipman S. M. Peacock	Nov. 11, 1873.
Cadet-Midshipman C. C. J. Norris	Nov. 26, 1873.
Cadet-Midshipman W. F. Ustick	Feb. 16, 1874.
Cadet-Midshipman C. R. Crenshaw	Mar. 16, 1874.
Cadet-Midshipman A. C. McClenan	Mar. 16, 1874.
Cadet-Midshipman J. F. LeBrou	Mar. 17, 1874.
Cadet-Midshipman F. C. Morris	April 6, 1874.
Cadet-Midshipman R. Horton	April 6, 1874.
Cadet-Midshipman A. R. Mitchell	May 1, 1874.
Cadet-Midshipman W. Crosby	May 1, 1874.
Cadet-Midshipman Thomas Green	May 1, 1874.
Cadet-Engineer T. F. Carter	May 4, 1874.
Cadet-Midshipman J. B. Gilder	May 4, 1874.
Cadet-Midshipman C. E. Lee	May 6, 1874.
Cadet-Midshipman H. R. Griffith	May 11, 1874.
Cadet-Engineer L. Morgan	May 14, 1874.
Cadet-Midshipman T. H. Taylor	May 14, 1874.
Cadet-Engineer C. H. Frizell	May 16, 1874.
Cadet-Midshipman W. G. Clark	June 11, 1874.
Cadet-Midshipman G. D. Donnelly	June 11, 1874.
Cadet-Midshipman E. C. Goss	June 11, 1874.
Cadet-Midshipman J. W. Albertson	June 11, 1874.
Cadet-Midshipman J. Ancona	June 11, 1874.
Cadet-Midshipman M. O. Bunn	June 11, 1874.
Cadet-Midshipman T. Dickinson	June 11, 1874.
Cadet-Midshipman R. M. Donovan	June 11, 1874.
Cadet-Midshipman F. S. Goalding	June 11, 1874.
Cadet-Midshipman W. C. Riorden	June 11, 1874.
Cadet-Midshipman W. C. Hagar	June 11, 1874.
Cadet-Midshipman H. S. Holmes	June 11, 1874.
Cadet-Midshipman H. B. Lindley	June 11, 1874.
Cadet-Midshipman J. L. Purcell	June 11, 1874.
Cadet-Midshipman E. P. Sanders	June 11, 1874.
Cadet-Midshipman W. K. Stevens	June 11, 1874.
Cadet-Midshipman W. L. Todd	June 11, 1874.
Cadet-Midshipman W. Vinson	June 11, 1874.
Cadet-Engineer C. N. Johnson	June 11, 1874.
Cadet-Engineer L. Olmsted	June 11, 1874.
Cadet-Engineer G. H. Claude	June 11, 1874.
Cadet-Engineer Harvey Eastman	Oct. 5, 1874.
Cadet-Midshipman J. S. Manley	Oct. 9, 1874.

Cadet-Midshipman H. C. White.....Oct. 9, 1874.
Cadet-Midshipman A. W. Wills.....Oct. 9, 1874.
Cadet-Midshipman H. G. Chase.....Oct. 9, 1874.
Cadet-Midshipman H. W. Ford.....Oct. 9, 1874.
Cadet-Midshipman N. J. L. T. Halpine.....Oct. 9, 1874.
Cadet-Midshipman S. M. Peacock.....Oct. 9, 1874.
Cadet-Midshipman J. D. Chase.....Oct. 9, 1874.
Cadet-Midshipman T. G. Harkness.....Oct. 9, 1874.
Cadet-Midshipman S. L. Heap.....Oct. 9, 1874.
Cadet-Midshipman J. A. Lockwood.....Oct. 9, 1874.
Cadet-Midshipman R. H. Lull.....Oct. 9, 1874.
Cadet-Midshipman B. W. Parker.....Oct. 9, 1874.
Cadet-Midshipman W. Sencerbox.....Oct. 9, 1784.
Cadet-Midshipman M. A. Vinton.....Oct. 9, 1874.
Cadet-Midshipman C. H. Walsh.....Oct. 9, 1874.
Cadet-Engineer G. L. Drouillard.....Oct. 9, 1874.

DISMISSALS.

Cadet-Midshipman A. C. Almy, dropped.....Mar. 31, 1874.
Cadet-Midshipman F. S. Goalding, dropped.....June 11, 1874.
Cadet-Midshipman H. B. Lindley, dropped.....June 11, 1874.
Cadet-Midshipman W. C. Riorden, dropped.....June 11, 1874.

SUMMER CRUISE, 1874.

OFFICERS AND CADET-MIDSHIPMEN

ATTACHED TO THE

UNITED STATES PRACTICE-SHIP CONSTELLATION.

Capt. K. RANDOLPH BREESE, *Commanding.*
Lieut.-Commander P. H. COOPER, *Executive Officer.*
Lieut.-Commander P. F. HARRINGTON, *Navigator.*
Lieut.-Commander A. G. CALDWELL, *Instructor in Navigation.*
Lieut.-Commander JOHN SCHOULER, *Senior Watch-Officer.*
Lieut. W. H. BROWNSON, *Watch-Officer.*
Lieut. ASA WALKER, *Watch-Officer.*
Lieut. E. D. F. HEALD, *Watch-Officer.*
Surgeon J. H. TINKHAM.
Acting Assistant Surgeon W. J. CRONYN.
Paymaster J. A. SMITH.
Chaplain J. R. MATTHEWS.
First Lieutenant D. P. MANNIX, U. S. M. C.
Captain's clerk, C. M. McLEOD.
Paymaster's clerk, F. C. ADAMS.
Boatswain, A. MILNE.
Gunner, R. SOMMERS.

CADET-MIDSHIPMEN.

First Class, (36.)

C. H. Amsden.	D. Daniels.	H. J. Hunt.	George Stoney.
F. E. Beatty.	R. M. Doyle.	R. Hunt.	R. H. Townley.
E. D. Bostick.	F. F. Fletcher.	A. E. Jardine.	N. R. Usher.
W. B. Caperton.	J. M. Helm.	C. Laird.	F. B. Vinton.
F. S. Carter.	H. M. Hodges.	J. S. Manley.	H. C. White.
F. W. Coffin.	A. C. Hodgson.	C. M. McCartney.	A. W. Wills.
F. S. Collins.	H. H. Hosley.	A. Sharp.	C. M. Winslow.
C. A. Corbin.	A. L. Howe.	J. A. Shearman.	M. L. Wood.
W. G. Cutler.	W. S. Hughes.	J. T. Smith.	G. H. Worcester.

Second Class, (14.)

D. R. Case.	H. C. Gearing.	S. B. Mallory.	A. W. Rollins.
W. J. Chambers.	A. L. Hall.	R. T. Mulligan.	F. H. Sherman.
A. E. Culver.	W. G. Hannum.	C. F. Pond.	W. L. Varnum.
G. C. Foulk.	R. Henderson.		

Third Class, (67.)

W. S. Benson.	J. H. Dykeman.	P. V. Lansdale.	O. J. Schoolcraft.
F. M. Bostwick.	W. F. Endress.	J. A. Lockwood.	W. Sencerbox.
J. K. Brice.	A. F. Fechteler.	R. H. Lull.	J. D. Sheeks.
W. V. Bronaugh.	L. C. Fletcher.	K. Machida.	B. W. Taylor.

F. M. Brumby.
F. S. Buckley.
W. L. Burdick.
F. B. Case.
M. C. Castle.
J. D. Chase.
S. Cook.
W. M. Constant.
W. G. David.
G. W. Denfeld.
A. W. Dodd.
O. G. Dodge.
H. O. Dunn.
A. B. Frenzel.
W. F. Fullam.
A. Gleaves.
A. W. Grant.
W. Green.
F. R. Heath.
B. W. Hodges.
F. Hodges.
C. W. Horton.
A. Jeffries.
H. C. Jones.
J. N. Jordan.
W. R. Rush.
A. C. Macomb.
T. B. Maynadier.
J. H. McNasser.
V. S. Nelson.
J. H. Oliver.
J. M. Orchard.
G. F. Ormsby.
W. B. Osterhout.
R. C. Paris.
B. W. Parker.
J. P. Parker.
H. H. Rogers.
H. Taylor.
F. W. Toppan.
H. C. Wakenshaw.
C. H. Walsh.
P. J. Werlich.
C. S. Williams.
J. C. Wilson.
A. G. Winterhalter.
H. M. Witzel.
A. N. Wood.
E. E. Wright.
R. K. Wright.

Fourth Class, (11.)

C. N. Atwater.
S. L. Blodgett.
W. C. Canfield.
A. D. Carrington.
B. C. Dent.
R. P. Fauntleroy.
W. E. W. Hall.
G. H. Hess.
J. G. Mason.
F. W. Ryan.
A. B. Tracy.

Sailed from Annapolis Roads, June 13; touched at Hampton Roads; crossed and re-crossed the Gulf Stream; cruised in Long Island Sound; touched at Newport, R. I., to witness torpedo practice, and arrived at the Naval Academy, September 22, 1874.

U. S. PRACTICE-STEAMER MAYFLOWER.

Lieut.-Commander O. A. BATCHELLER, *Commanding.*
Master, JOHN A. NORRIS.
Past Assistant Engineer, G. E. TOWER.
Past Assistant Engineer, C. H. MANNING.
Assistant Surgeon, J. M. AMBLER.
Assistant Paymaster, W. W BARRY.
Mate, C. J. MURPHY.
Mate, T. W. BONSALL.

CADET-ENGINEERS.

First Class, (17.)

G. H. T. Babbitt.
F. H. Bailey.
T. F. Burgdorff.
W. L. Cathcart.
W. Cowles.
G. L. Drouillard.
W. B. Dunning.
F. H. Eldridge.
E. R. Freeman.
W. R. King.
C. Kleckner.
W. N. Little.
E. N. Loomis.
A. de Ruiz.
G. S. Willits.
E. T. Warburton.
W. F. Worthington.

Second Class, (2.)

R. I. Reid.
H. H. Stivers.

Left her anchorage June 12 and proceeded to Washington, D. C.; touched at the navy-yard; steamed thence, touching at Norfolk, for the navy-yard, New York; thence to the navy-yards, Boston and Portsmouth, N. H., thence to Providence, R. I., Cold Spring, and West Point, N. Y., Wilmington, Del., Chester, Pa., navy-yard, Philadelphia, and thence for the Chesapeake Bay; touching at Hampton Roads, and arrived at the Naval Academy, September 22, 1874.

THE MERIT-ROLLS.

EXTRACT FROM CHAPTER VII. OF THE REGULATIONS OF THE UNITED STATES NAVAL ACADEMY.

At every annual examination, the Academic Board shall form a general merit-roll for each class, in the following manner: Of those members of each class who shall have received a satisfactory final average in any principal branch, the individual having the highest standing shall receive the maximum number assigned to such branch for that class and year in the table of maximum numbers, and the one having the lowest satisfactory average shall receive one-third of the maximum number; members of the class having intermediate standings shall receive numbers decreasing by equal differences from the maximum to one-third of the maximum, and members who have not received a satisfactory final average shall receive numbers decreasing by the same equal differences from one-third of the maximum, the class being arranged in order of merit, as fixed by their relative standing in the branch considered.

Of those who have not been found deficient in conduct, such as have no demerits shall receive the maximum number allowed for that class and year, and the others shall have that maximum diminished by one one-thousandth part of itself for every demerit recorded against them. All the numbers which shall be thus assigned to the several members for the several branches of study and for conduct shall then be added together, and the names of the members shall be arranged in each class according to the aggregates thus obtained, the highest number being placed first on the list, and the others in their order.

At the final academic examination, the Academic Board shall make up the "graduating merit-roll" for this class, by adding the numbers which each member of the class shall have received on the several "general merit-rolls" for the four years, and arranging the order of numbers according to the aggregates, placing the highest first. If any member has been put back from a higher class, the numbers from the merit-rolls of his former class shall be used to supply deficiencies.

RULES ADOPTED BY THE ACADEMIC BOARD TO BE OBSERVED IN PREPARING THE MERIT-ROLLS.

1. No final average below 2.50 (on a scale of 4) shall be considered *satisfactory* in assigning the multiples.

2. Whenever the same class-number shall be assigned to two or more persons in any branch, each shall receive as his multiple in that branch the *mean* of all the multiples which would have been assigned to such persons had they been numbered consecutively.

3. Whenever, for any reason, the class-standing of any person shall not be made out until after the multiples of the remainder of his class have been determined, the multiple assigned to such person in each branch shall be the *mean* of the multiples of the two members of his class between whom his relative standing in that branch places him.

4. Whenever the merit-rolls of a former class are used to supply deficiencies in the graduating merit-roll in the case of any Cadet who has been turned back, he shall receive the aggregate multiple which was allowed him in his former class, unless the maximum number allowed to that class in the table of maxima differs from the maximum number for the corresponding year of the class in which he was placed; in which case his aggregate multiple is to be increased or diminished in the same proportion as the maximum number of his former class has been increased or diminished.

Table of relative weights or maximum numbers to be assigned to each of the principal branches in preparing the merit-rolls.

CADET-MIDSHIPMEN.

Department.	Principal branches.	First year—Fourth class.	Second year—Third class.	Third year—Second class.	Fourth year—First class.	Graduating maximum in the principal branches.
Seamanship	Seamanship	.....	75	99	120	294
	Practical Exercises	.....	.....	30	51	81
	Naval Tactics	.....	.....	24	.....	24
	Ship-building	.....	.....	24	.....	24
Ordnance and Gunnery	Gunnery	.....	.....	45	84	129
	Ordnance Instructions	.....	48	.....	.....	48
	Infantry Tactics	.....	.....	30	.....	30
	Fencing	.....	.....	9	9	18
Mathematics	Algebra and Geometry	120	.....	.....	.....	120
	Trigonometry, Analytical Geometry, and Descriptive Geometry	.....	162	.....	.....	162
Astronomy, Navigation, and Surveying	General astronomy	.....	.....	45	.....	45
	Navigation and Surveying	.....	.....	.....	153	153
Physics and Chemistry	Chemistry	.....	45	.....	.....	45
	Heat and Climatology	.....	.....	.....	45	45
	Optics and Acoustics	.....	.....	.....	30	30
	Magnetism and Electricity	.....	.....	45	.....	45
	Applied Mathematics	.....	.....	60	.....	60
	Applied Mathematics and Mechanics	.....	.....	60	.....	60
English Studies, History, and Law	International law	.....	.....	.....	30	30
	Rhetoric	.....	42	.....	.....	42
	Physical Geography	.....	33	.....	.....	33
	English	30	.....	.....	.....	30
	History	42	.....	.....	.....	42
Modern Languages	French	24	60	60	.....	144
	Spanish	.....	.....	.....	30	30
Drawing	Sketching and Topography	.....	18	30	.....	48
Steam-enginery	Marine-engines, Boilers, &c	.....	.....	.....	84	84
Aggregate		216	483	561	636	1,896
Conduct		15	55	120	210	400

CADET-ENGINEERS.

Mathematics	Algebra and Geometry	120	.....	.....	.....	.....
	Algebra, Trigonometry, Descriptive and Analytical Geometry	.....	.....	150	.....	.....
Physics and Chemistry	Heat	.....	.....	.....	45	.....
	Electricity	.....	.....	.....	45	.....
	Applied Mathematics	.....	.....	.....	60	.....
	Applied Mathematics and Mechanics	.....	.....	.....	60	.....
	Chemistry	.....	.....	.....	99	.....
English Studies, History, and Law	English	30	.....	.....	.....	.....
	History	42	.....	.....	.....	.....
Modern Languages	French	24	.....	51	45	.....
Steam-enginery	Steam-enginery	.....	.....	99	.....	.....
	Steam	.....	.....	.....	198	.....
Aggregate		216	.....	300	552	.....
Conduct		15	.....	55	150	.....

MERIT-ROLLS FOR 1873-74.

NOTE.

Cadets whose names are marked thus (*) are the five most distinguished in their respective classes.

Those marked thus (†) were found deficient, but were allowed to continue in their classes on condition of passing at a re-examination.

Those marked thus (‡) were found deficient, and turned back, to recommence the studies of their respective classes.

Those marked thus (§) were found deficient, and recommended to be dropped.

Numbers in parentheses indicate final averages below 2.50.

a denotes absence from examination.

UNITED STATES NAVAL ACADEMY.

Merit-roll of the First Class, (30 members,) annual examination, May, 1874, and general merit-roll for four years.

	Names in order of general merit.	State.	Date of admission.	Age at date of admission.		Seamanship.	Practical exercises in Seamanship.	Gunnery.	Fencing.	Steam-enginery.	Navigation.	Heat.	Light.	Law.	Spanish.	Conduct.	Aggregate fourth year.	Aggregate third year.	Aggregate second year.	Aggregate first year.	Graduating maximum.
				Years.	Months.	120	51	84	9	84	153	45	30	30	30	210	846	669	526	105	2146
*1	George H. Peters	Pennsylvania	June 23, 1870	15	9	117.24	44.20	84.00	8.79	82.07	148.75	45.00	30.00	30.00	29.31	207.90	827.26	615.50	466.97	82.69	1992.42
*2	Bradley A. Fiske	Ohio	Sept. 22, 1870	16	3	95.17	19.04	78.21	8.38	70.48	140.25	42.69	27.00	29.31	27.93	190.47	728.93	592.95	474.06	89.79	1885.73
*3	Frank H. Holmes	California	June 29, 1870	17	9	120.00	36.04	76.28	3.93	80.14	123.25	43.85	28.00	23.79	13.45	193.83	742.56	592.19	465.41	82.93	1883.09
*4	Albert Wegmann	New York	Sept. 21, 1870	16	5	108.97	34.68	45.38	5.69	57.93	144.50	21.92	26.00	15.52	28.62	186.69	675.90	614.77	485.28	89.85	1865.80
*5	John W. Stewart	Indiana	Sept. 28, 1870	17	4	84.14	42.84	80.14	5.69	74.34	127.50	40.38	22.00	26.55	25.86	202.86	732.30	572.54	422.33	68.26	1795.43
6	Henry F. Reich	Pennsylvania	Sept. 27, 1870	17	10	80.00	29.24	72.41	7.14	76.28	114.75	39.23	11.00	28.62	26.55	207.48	692.70	561.70	454.38	85.86	1794.64
7	Lucian Flynne	Texas	Sept. 22, 1870	15	10	89.66	19.04	82.07	6.93	78.21	153.00	41.54	29.00	27.24	30.00	189.42	746.11	493.59	429.68	78.23	1747.61
8	Hamilton Hutchins	New Hampshire.	June 23, 1870	15	6	106.21	45.56	51.17	3.93	72.41	131.75	31.15	21.00	16.21	27.24	180.60	687.23	550.69	412.16	86.94	1737.02
9	York Noell	Pennsylvania	Sept. 20, 1870	16	5	59.31	12.92	70.48	6.62	52.14	119.00	28.85	13.00	17.59	23.79	183.33	587.03	523.74	449.49	83.65	1643.91
10	John F. Parker	Ohio	Sept. 29, 1870	17	5	95.17	40.12	68.55	4.45	68.55	61.63	38.08	25.00	25.86	22.07	178.71	628.19	521.96	384.35	69.09	1603.59
11	Matthew G. Reynolds	Missouri	Sept. 21, 1870	15	10	114.48	51.00	41.52	9.00	60.83	136.00	27.69	19.00	16.90	16.21	192.57	685.20	481.04	317.73	59.50	1543.47
12	John C. Colwell	At large	Sept. 22, 1870	14	1	73.10	38.08	60.83	3.62	64.69	89.25	34.62	(5.00)	18.97	19.66	182.49	590.31	478.76	383.20	74.69	1526.96
13	William E. Whitfield	Arkansas	June 21, 1870	17	11	102.07	22.44	74.34	7.97	39.59	76.50	16.15	(6.00)	12.76	23.10	194.46	575.38	514.76	347.61	76.83	1514.58
14	W. R. A. Rooney	Pennsylvania	Sept. 28, 1870	16	8	40.00	17.00	43.45	7.55	41.52	102.00	35.77	24.00	22.41	24.83	189.21	547.74	488.51	345.72	75.85	1457.82
15	Edward J. Dorn	Missouri	Sept. 21, 1870	16	8	86.90	41.48	58.90	5.69	57.93	55.25	25.38	15.50	27.93	22.07	200.76	597.79	443.42	334.29	77.08	1452.58
16	Edward C. Fuller	Ohio	Sept. 27, 1870	17	11	64.83	25.84	62.76	6.62	84.00	80.75	36.92	(4.00)	14.14	10.69	180.18	570.73	433.22	378.02	67.74	1449.71
17	Winslow Allderdice	Virginia	June 17, 1870	16	2	75.86	15.64	55.03	4.76	66.62	68.00	33.46	10.00	18.28	10.00	190.26	547.91	474.99	337.68	78.64	1439.22
18	George E. Hutter	Virginia	June 21, 1870	17	3	95.17	38.08	47.31	4.24	52.14	110.50	26.54	12.00	21.03	16.90	198.87	622.78	413.12	326.99	65.93	1428.82
19	Warner H. Nostrand	New York	Sept. 23, 1870	17	10	70.34	25.84	39.59	3.41	44.41	106.25	30.00	18.00	12.07	18.28	182.49	550.68	442.80	350.68	75.66	1419.82
20	Bernard O. Scott	Alabama	June 29, 1870	14	5	80.00	48.96	33.79	7.55	32.83	97.75	20.77	(9.00)	23.10	24.83	208.95	587.53	404.17	322.81	60.36	1374.87
21	Lyman Arms	Michigan	Sept. 24, 1870	16	10	102.07	33.32	56.97	8.59	55.03	(46,75)	23.08	14.00	20.34	20.69	180.39	561.23	430.46	295.00	66.83	1353.52
22	Frank J. Milligan	Tennessee	June 29, 1869	16	6	67.59	30.60	64.69	3.21	47.31	61.63	(11.54)	(8.00)	19.66	15.52	196.14	525.89	369.72	347.34	55.45	1298.40
23	Charles W. Haskell	Iowa	June 23, 1870	16	10	48.28	27.88	66.62	4.76	37.66	51.00	21.23	(3.00)	21.72	12.41	192.36	489.92	403.55	309.79	65.66	1268.92
24	Edwin L. Reynolds	New Jersey	June 21, 1870	17	3	56.55	21.08	53.10	5.17	35.72	72.25	18.46	(2.00)	11.38	14.83	195.72	486.26	396.92	286.05	73.37	1242.60
25	John Farnsworth	Illinois	Sept. 25, 1869	14	0	51.03	14.28	29.93	6.10	28.00	93.50	19.62	20.00	10.69	17.59	184.38	475.12	337.95	238.93	53.34	1105.34
†26	John M. Bowyer	Iowa	Sept. 28, 1870	17	3	111.72	48.96	49.24	5.17	62.76	(36.13)	32.31	(7.00)	25.17	18.97	205.59	603.02	464.12	314.64	60.25	1442.03
†27	John O. Nicolson	Alabama	June 29, 1869	16	4	62.07	11.56	31.86	3.00	29.93	(42.50)	(12.69)	15.50	13.45	20.69	191.31	434.56	336.95	348.16	67.78	1187.45
†28	George T. Emmons	At large	June 4, 1870	17	11	42.76	31.96	37.66	6.31	44.41	(36.13)	17.31	17.00	24.48	12.41	199.71	470.14	367.44	276.14	69.79	1183.51
†29	David Peacock	New Jersey	Sept. 28, 1869	15	4	45.52	23.80	28.00	8.17	49.24	85.00	15.00	23.00	10.00	11.38	180.39	479.50	366.44	268.48	50.72	1165.11
†30	Frederick W. Danner	Alabama	June 23, 1869	17	7	53.79	46.92	35.72	7.55	32.83	(29.75)	(13.85)	(1.00)	14.83	14.14	180.60	430.98	366.44	214.24	69.09	1080.75

†*By a recent decision of the Navy Department the multiples opposite these names are to be revised.*

Merit-roll of the Second Class, (37 members,) annual examination, May, 1874.

	Names in order of annual merit.	State.	Date of admission.	Age at date of admission.		Seamanship.	Practical exercises in Seamanship.	Naval Tactics.	Ship-building.	Gunnery.	Infantry Tactics.	Fencing.	Astronomy.	Magnetism and Electricity.	Applied Mathematics and Mechanics.	Applied Mathematics.	French.	Drawing.	Conduct.	Aggregate.
				Years.	Months.	99	30	24	24	45	30	9	45	45	60	60	60	30	120	681
*1	**Albon C. Hodgson**	Georgia	June 5, 1871	17	10	93.50	29.41	23.56	23.56	45.00	30.00	5.33	45.00	43.85	60.00	60.00	60.00	10.28	103.56	633.05
*2	**Charles H. Amsden**	Ohio	Sept. 20, 1871	17	11	95.33	27.94	16.89	24.00	40.83	27.78	8.33	34.41	45.00	55.43	51.72	56.67	25.00	105.60	614.93
*3	**Cameron M. Winslow**	At large	Sept. 27, 1870	16	1	89.83	30.00	22.67	21.33	35.83	27.22	9.00	41.47	41.54	56.57	58.62	47.22	29.44	104.04	614.78
*4	**Walter S. Hughes**	Iowa	Sept. 24, 1870	17	11	88.00	16.47	23.11	21.78	34.17	22.22	5.50	42.35	40.38	53.14	42.07	48.89	26.11	120.00	584.19
*5	**Charles Laird**	Ohio	Sept. 28, 1870	16	7	97.17	16.47	24.00	22.67	42.50	26.11	4.00	35.29	36.92	49.71	53.10	33.33	27.50	103.92	572.69
6	Frank F. Fletcher	Iowa	Sept. 22, 1870	14	10	78.83	21.18	21.78	12.89	33.33	13.89	7.67	44.12	38.65	58.86	57.24	39.44	28.33	108.12	564.33
7	Nathaniel R. Usher	Indiana	Sept. 21, 1871	16	5	69.67	16.47	22.22	20.89	43.33	24.44	7.17	33.53	34.62	41.71	54.48	42.22	22.50	97.80	531.05
8	Harry H. Hosley	New Hampshire	Sept. 22, 1871	15	10	74.25	16.47	18.44	14.67	26.67	29.44	5.00	24.71	42.69	47.43	50.34	58.89	16.11	100.44	525.55
9	William G. Cutler	At large	Sept. 20, 1871	16	11	60.50	21.18	12.44	16.00	30.00	22.78	5.83	39.71	31.15	57.71	46.21	54.44	18.06	100.32	525.33
10	Clarence A. Corbin	Michigan	Sept. 26, 1870	17	2	84.33	25.00	11.11	16.89	25.00	28.89	5.17	30.88	35.77	48.57	48.97	47.22	16.94	97.68	522.42
11	Moses L. Wood	Missouri	Sept. 21, 1871	17	1	55.92	16.47	20.44	9.78	39.17	15.00	8.67	31.76	30.00	50.86	55.86	35.56	26.67	111.24	507.40
12	James M. Helm	Tennessee	Sept. 29, 1871	15	9	99.00	21.18	19.33	12.00	28.33	21.11	8.83	36.62	(11.54)	54.29	47.59	32.22	10.28	104.40	506.72
13	Frederick W. Coffin	Massachusetts	June 15, 1870	17	9	66.00	16.47	16.44	10.22	40.00	21.67	7.33	40.59	24.81	52.00	40.69	55.56	11.39	103.20	506.37
†14	Fydelio S. Carter	Illinois	Sept. 29, 1870	17	4	86.17	26.18	11.56	23.11	37.50	17.22	7.83	(13.24)	21.35	39.43	35.17	53.33	22.50	106.68	501.27
15	Harry M. Hodges	Illinois	Sept. 29, 1870	15	3	67.83	23.53	16.00	17.33	30.83	11.11	4.17	43.24	28.85	42.86	44.83	35.56	23.61	109.56	499.31
16	John A. Shearman	New York	June 7, 1871	16	10	78.83	23.53	20.44	8.44	23.33	15.56	5.67	38.82	21.35	44.00	43.45	37.78	19.17	97.80	478.17
17	Alexander Sharp	Dist. of Columbia	June 20, 1870	14	7	78.83	27.06	18.44	19.56	41.67	23.89	6.67	32.65	(5.77)	37.14	26.90	22.78	20.56	105.24	467.16
18	Richard H. Townley	Nebraska	June 20, 1870	17	4	62.33	26.18	21.33	20.44	38.33	28.33	8.33	25.59	27.69	36.00	29.66	28.33	11.39	98.04	461.97
19	George H. Worcester	New York	Sept. 26, 1871	14	3	47.67	14.12	20.44	20.00	44.17	20.56	4.67	37.94	38.65	40.57	33.79	28.33	13.89	96.24	461.04
20	Edward D. Bostick	South Carolina	Sept. 24, 1870	17	1	91.67	21.18	17.78	17.78	25.83	20.00	3.00	29.12	15.00	25.71	(15.86)	41.11	21.39	104.16	449.59
21	Alfred L. Howe	Pennsylvania	Sept. 28, 1870	16	5	74.25	11.47	19.33	12.44	36.67	23.33	3.83	17.21	18.46	22.29	20.00	45.00	30.00	105.60	439.88
§22	Willie G. Clark	At large	June 28, 1870	16	10	40.33	21.18	10.22	14.22	27.50	25.56	6.08	(14.12)	32.88	28.00	(17.24)	51.11	27.50	120.00	435.94
23	Robert M. Doyle	Tennessee	Sept. 21, 1870	16	4	64.17	12.35	12.00	11.11	22.50	18.33	3.58	26.47	24.81	45.14	39.31	22.78	19.17	108.00	429.72
24	David Daniels	Massachusetts	June 5, 1871	15	4	58.67	16.47	14.44	16.44	29.17	16.11	6.08	15.00	32.88	33.14	23.45	39.44	13.89	109.56	424.74
†25	Augustus E. Jardine	At large	Sept. 21, 1870	15	8	71.50	10.00	15.56	15.56	24.17	19.44	6.50	22.06	(6.92)	33.14	(13.10)	43.33	13.89	118.44	413.61
†26	James S. Manley	Maine	Sept. 29, 1871	17	5	82.50	23.53	14.44	22.22	16.67	26.67	6.83	19.41	(9.81)	20.00	(14.48)	30.00	23.61	99.24	409.41
27	Henry J. Hunt	At large	June 23, 1870	15	2	55.92	27.94	13.33	18.22	18.33	12.78	8.33	27.79	26.54	30.29	23.45	20.00	28.89	96.60	408.41
†28	Allen W. Wills	Pennsylvania	Sept. 21, 1870	17	6	44.92	13.24	15.11	19.11	35.00	17.78	6.33	22.94	(12.69)	(18.86)	(11.72)	50.00	20.00	113.76	401.46
29	James T. Smith	North Carolina	June 5, 1871	16	3	42.17	11.47	9.33	10.67	31.67	13.33	3.33	27.79	19.62	29.14	(18.62)	52.22	15.00	117.00	401.36
30	Frank E. Beatty	Minnesota	Sept. 21, 1871	17	9	38.50	19.12	14.44	8.00	21.67	10.56	4.33	36.62	23.08	46.29	36.55	26.67	12.78	102.24	400.85
31	Frederick B. Vinton	New York	Sept. 20, 1871	16	9	49.50	13.24	12.89	13.78	20.83	14.44	4.83	30.00	(13.85)	24.57	37.93	45.00	12.22	104.16	397.24

Merit-roll of the Second Class, (37 members,) annual examination, May, 1874—Continued.

	Names in order of annual merit.	State.	Date of admission.	Age at date of admission.		Seamanship.	Practical exercises in Seamanship.	Naval Tactics.	Ship-building.	Gunnery.	Infantry Tactics.	Fencing.	Astronomy.	Magnetism and Electricity.	Applied Mathematics and Mechanics.	Applied Mathematics.	French.	Drawing.	Conduct.	Aggregate.
				Years.	Months.															
						99	**30**	**24**	**24**	**45**	**30**	**9**	**45**	**45**	**60**	**60**	**60**	**30**	**120**	**681**
32	William B. Caperton	Tennessee	June 5, 1871	15	11	36.67	(8.82)	17.33	11.56	20.00	12.22	8.00	18.53	17.31	38.29	31.03	35.56	21.39	117.72	394.43
33	Charles M. McCartney	Pennsylvania	Sept. 23, 1869	15	1	41.92	10.59	8.67	8.89	17.50	10.00	3.58	23.82	(4.62)	21.14	21.38	57.78	25.56	105.00	363.45
†34	George Stoney	Alabama	Sept. 20, 1870	17	11	52.25	19.12	9.78	9.33	19.17	16.67	4.50	20.29	(3.46)	34.86	32.41	21.11	18.06	102.12	363.13
35	Frank S. Collins	At large	Sept. 25, 1871	17	2	34.83	(9.41)	10.67	18.67	32.50	18.89	7.50	21.18	16.15	23.43	25.52	31.11	15.56	97.68	363.10
36	Ridgely Hunt	Louisiana	Sept. 20, 1870	16	7	52.25	25.00	8.67	13.33	15.83	11.67	3.17	15.88	(9.81)	26.86	28.28	24.44	24.44	102.48	362.11
†37	Hunter C. White	Rhode Island	June 11, 1870	16	5	33.00	28.82	8.00	15.11	15.00	25.00	7.00	17.21	(8.08)	31.43	(10.34)	25.56	16.94	100.44	341.93

UNITED STATES NAVAL ACADEMY.

Merit-roll of the Third Class, (56 *members,*) *annual examination, May,* 1874.

	Names in order of annual merit.	State.	Date of admission.	Age at date of admission.		Seamanship.	Ordnance Instruction.	Mechanical Drawing.	Mathematics.	Chemistry.	History and Composition.	Rhetoric.	French.	Drawing.	Conduct.	Aggregate.
				Years.	Months.	75.00	48.00	12.00	150.00	45.00	33.00	42.00	60.00	18.00	55.00	538.00
*1	**Stimson J. Brown**	New York	Sept. 16, 1872	17	11	72.06	43.77	5.60	147.73	42.50	32.15	39.67	60.00	17.09	42.30	502.87
*2	**Henry C. Gearing**	Pennsylvania	June 12, 1872	17	3	62.25	41.96	6.18	150.00	43.13	32.58	37.33	55.74	13.92	41.91	485.00
*3	**Burns T. Walling**	Ohio	June 5, 1872	17	4	64.22	46.79	7.35	138.64	43.75	30.46	37.92	53.62	9.40	44.50	476.65
*4	**James H. Sears**	New York	Sept. 20, 1871	16	8	70.10	44.98	7.64	138.64	40.00	24.54	36.75	50.21	17.43	41.91	472.20
*5	**Edward M. Katz**	Wisconsin	June 8, 1872	16	7	63.24	40.15	10.40	129.55	45.00	31.73	35.00	53.62	16.64	42.35	467.68
6	Templin M. Potts	At large	June 6, 1872	16	7	68.14	48.00	7.35	138.64	36.35	29.19	34.42	54.89	7.81	41.31	466.00
7	William H. Allen	Illinois	Sept. 26, 1872	15	10	66.18	39.55	4.51	145.45	44.38	24.12	39.08	45.96	9.40	47.36	465.99
8	Walter McLean	At large	June 6, 1872	16	10	67.16	47.40	5.24	131.82	41.25	33.00	42.00	35.74	10.08	48.79	462.48
9	George C. Foulk	Pennsylvania	June 14, 1872	15	7	73.04	41.36	9.74	119.32	38.75	31.31	38.50	47.23	16.19	46.70	462.14
10	Charles C. Rogers	Tennessee	June 7, 1872	16	0	38.73	37.74	6.69	143.18	34.38	30.04	40.83	58.30	14.49	50.33	454.71
11	Clifford J. Boush	Virginia	June 5, 1872	17	9	71.08	46.19	9.74	115.91	37.50	23.69	29.75	50.21	16.42	50.44	450.93
12	Stephen Jenkins	New York	Sept. 20, 1871	14	2	65.20	25.06	11.42	122.73	33.75	30.88	41.42	56.60	15.62	46.42	449.10
13	John T. Newton	At large	Oct. 14, 1872	17	0	52.94	37.13	8.07	125.00	35.63	27.08	33.25	59.15	10.87	45.49	434.61
14	Thomas G. Wineh	Ohio	Sept. 20, 1872	17	10	55.88	38.34	11.71	127.27	41.88	27.92	32.67	20.00	16.87	43.45	415.99
15	L. K. Reynolds	Alabama	June 5, 1871	14	4	74.02	43.17	8.36	103.41	31.88	25.81	30.33	35.74	11.89	42.35	406.96
16	William L. Varnum	Pennsylvania	June 5, 1871	16	6	75.00	45.58	8.95	119.32	28.13	27.50	16.33	21.70	10.30	50.38	403.19
17	Anthony W. Rollins	Kentucky	June 10, 1872	17	3	57.35	30.49	5.89	134.09	18.13	22.42	27.42	38.30	13.36	45.16	392.61
18	Abraham E. Culver	New York	June 5, 1872	16	2	41.18	17.81	6.18	109.09	33.13	28.35	36.17	52.34	14.15	47.63	386.03
19	Charles F. Pond	Connecticut	June 12, 1872	15	7	41.18	31.70	10.04	113.64	25.63	29.62	35.58	40.85	15.28	41.64	385.16
20	James C. Gilmore	Pennsylvania	Sept. 20, 1871	17	2	55.88	40.75	12.00	93.18	32.50	17.77	28.58	37.02	17.77	48.68	384.13
21	Henry T. Mayo	Vermont	June 13, 1872	15	6	60.78	44.38	4.87	103.41	21.25	25.38	29.17	38.30	14.49	41.80	383.83
22	William Braunersreuther	Illinois	Sept. 23, 1871	17	7	60.78	42.57	6.18	103.41	39.38	14.81	21.58	32.34	9.85	50.00	380.90
23	Robert C. Ray	At large	Oct. 1, 1872	17	11	37.26	35.92	8.95	111.36	23.75	26.65	20.71	44.26	7.81	49.72	366.39
24	Charles A. Gove	New Hampshire	June 5, 1871	16	11	58.33	32.60	11.20	97.73	31.25	20.73	22.75	26.81	10.87	43.18	355.45
‡25	A. C. Macomb	At large	Sept. 24, 1872	17	11	50.49	32.60	10.91	62.50	40.63	19.88	32.08	48.09	9.40	(36.08)	342.66
26	Richard Henderson	North Carolina	Sept. 28, 1872	17	1	45.10	19.62	7.35	103.41	35.00	16.92	19.83	32.34	14.83	43.18	337.58
27	John M. Proudfit	At large	Sept. 24, 1872	17	5	46.57	33.51	10.04	88.64	18.75	16.08	19.25	42.55	11.89	42.90	330.18
28	Waldemar D. Rose	At large	June 5, 1872	15	11	48.04	29.89	7.05	77.27	29.38	23.27	23.92	28.94	12.34	50.05	330.15
29	Francis H. Sherman	Missouri	Sept. 20, 1871	16	5	43.63	31.09	11.56	75.00	27.50	22.85	25.67	28.94	11.89	49.61	327.74
30	Daniel R. Case	At large	June 5, 1872	15	0	52.94	23.85	7.85	90.91	28.75	22.00	28.00	21.70	8.26	(39.66)	323.92
31	William G. Hannum	Pennsylvania	Sept. 23, 1872	16	1	49.51	25.66	8.95	82.95	20.00	24.96	26.83	34.04	8.72	42.19	323.81
32	De Witt Coffman	Virginia	June 6, 1872	17	6	52.94	38.94	5.60	62.50	20.63	19.04	14.87	39.57	11.32	54.45	319.86
33	William S. Hogg	At large	Sept. 24, 1872	15	10	48.04	21.43	10.69	95.45	21.88	15.65	18.37	25.96	10.53	50.77	318.77
†34	L. W. Piepmeyer	At large	Sept. 22, 1871	17	0	33.82	34.72	6.47	(45.45)	16.88	28.77	40.25	48.94	12.91	45.71	313.92
†35	N. J. L. T. Halpine	New York	June 9, 1871	14	8	69.12	28.08	11.20	(38.64)	19.38	13.54	26.25	57.45	6.00	41.31	310.97

UNITED STATES NAVAL ACADEMY.

Merit-roll of the Third Class, (56 members,) annual examination, May, 1874—Continued.

	Names in order of annual merit.	State.	Date of admission.	Age at date of admission.		Seamanship.	Ordnance Instruction.	Mechanical Drawing.	Mathematics.	Chemistry.	History and Composition.	Rhetoric.	French.	Drawing.	Conduct.	Aggregate.
				Years.	Months.	75.00	48.00	12.00	150.00	45.00	33.00	42.00	60.00	18.00	55.00	538.00
36	Henry Minett	Kentucky	June 8, 1872	15	9	41.18	29.28	6.91	82.95	26.25	21.58	22.17	24.68	13.36	41.42	309.78
37	S. B. Mallory	Virginia	June 12, 1872	16	0	32.84	28.68	4.87	82.95	22.50	21.15	31.50	30.64	8.49	44.99	308.61
38	Benjamin Tappan	Arkansas	Sept. 21, 1871	15	5	34.80	35.32	7.85	55.68	24.38	19.46	33.83	42.55	6.68	45.32	305.87
39	Henry A. Johnson	At large	June 5, 1872	17	0	45.10	23.25	11.85	82.95	15.63	11.42	25.08	27.66	18.00	42.08	303.02
40	Edward E. Wise	At large	June 5, 1871	16	6	29.90	26.87	10.25	71.59	25.00	13.12	20.71	40.85	17.43	43.95	299.67
†41	Samuel M. Peacock	Kentucky	Sept. 20, 1871	17	11	52.94	28.89	10.33	(34.09)	36.88	24.29	30.92	(14.89)	12.57	53.02	298.82
42	Alfred L. Hall	Ohio	Sept. 16, 1872	17	11	59.31	36.53	9.53	59.09	30.00	13.96	14.00	24.68	7.81	43.84	298.75
†43	Washington I. Chambers	New York	June 5, 1871	15	2	41.18	26.26	10.91	67.05	(13.75)	12.69	(12.83)	45.96	15.62	44.99	291.24
44	Thomas D. Griffin	Virginia	Sept. 20, 1872	17	9	26.96	22.04	4.51	67.05	16.25	18.19	24.50	51.49	7.36	52.80	291.15
45	Richard T. Mulligan	New Jersey	June 5, 1871	15	0	30.88	34.11	8.22	71.59	26.88	18.62	14.87	(19.15)	15.96	45.71	285.99
46	Elstner Fisher	Pennsylvania	Sept. 21, 1872	17	11	(24.02)	16.60	9.24	52.27	38.13	16.50	15.75	23.40	13.70	41.47	251.08
†47	Hermann F. Grabo	New Jersey	Sept. 22, 1871	16	0	28.92	(15.40)	8.58	50.00	15.00	(10.15)	18.37	34.04	15.06	49.34	244.86
†48	George D. Donnelly	Arkansas	Sept. 23, 1872	16	6	(23.04)	24.45	4.29	(40.91)	23.13	26.23	23.33	21.70	12.91	42.13	242.12
‡49	Cyrus W. Horton	New York	June 12, 1872	16	11	37.26	22.64	9.38	(36.36)	30.63	14.38	16.92	30.64	6.23	(37.29)	241.73
†50	Thomas N. Wood	At large	June 6, 1871	16	7	35.78	27.47	10.55	(29.55)	17.50	20.31	(13.42)	(18.30)	11.32	42.46	226.66
51	Giro Kunitomo	Empire of Japan	Oct. 7, 1872	17	1	31.86	20.23	4.87	55.68	(11.88)	15.23	(11.08)	.....	6.68	50.22	207.73
†52	Henry W. Ford	Georgia	June 5, 1871	17	4	27.94	17.21	6.69	(43.18)	(13.13)	12.27	17.50	(17.45)	(5.77)	41.69	202.83
53	Koroku Katz	Empire of Japan	June 7, 1871	16	4	25.00	18.42	8.58	(47.73)	(12.50)	11.85	(11.96)	.....	8.94	46.53	191.51
§54	Edwin C. Goss	South Carolina	Sept. 20, 1871	16	8	25.98	19.02	4.15	(31.82)	(14.38)	(9.73)	(11.96)	(16.17)	6.68	41.53	181.42
†	Henry G. Chase	Illinois	Sept. 22, 1871	17	10	*a*	16.00	5.24	*a*	*a*	(10.48)	*a*	(16.17)	7.13	53.08	.....
‡	Edward R. Poland	Vermont	Sept. 21, 1871	16	6	*a*	20.83	4.00	*a*	*a*	11.00	*a*	44.26	*a*	49.73	.....

UNITED STATES NAVAL ACADEMY.

Merit-roll of the Fourth Class, (98 members,) annual examination, May, 1874.

	Names in order of annual merit.	State.	Date of admission.	Age at date of admission.		Mathematics.	Grammar.	History and Composition.	French.	Conduct.	Aggregate.
				Years.	Months.	120	30	42	24	15	231
* 1	**William F. Fullam**	New York	Sept. 24, 1873	17	11	117.38	29.73	42.00	21.87	14.87	225.85
* 2	**Horace M. Witzel**	Wisconsin	June 5, 1873	15	14	120.00	29.45	40.34	20.16	14.01	223.96
* 3	**Albert G. Winterhalter**	Michigan	Sept. 22, 1873	16	11	113.44	29.18	38.68	23.79	14.39	219.48
* 4	**August F. Fechteler**	New York	June 5, 1873	15	0	118.69	26.44	37.58	23.15	11.33	217.19
* 5	**James H. Oliver**	Georgia	June 12, 1873	16	0	112.13	25.89	38.32	23.36	13.55	213.25
6	William V. Bronaugh	Kentucky	June 5, 1873	17	9	116.07	26.99	39.42	17.28	12.26	212.02
7	George F. Ormsby	Ohio	Sept. 24, 1873	17	4	108.20	27.53	41.26	18.03	14.16	209.18
8	Valentine S. Nelson	Tennessee	June 6, 1873	17	5	109.51	25.07	39.79	16.75	14.64	205.76
9	John M. Orchard	Missouri	June 11, 1873	15	9	114.75	26.71	30.58	16.96	11.24	200.24
10	Frank M. Bostwick	Wisconsin	Sept. 26, 1873	16	5	99.67	27.26	36.47	21.55	12.77	197.72
11	John N. Jordan	Maine	June 5, 1873	17	8	106.89	23.79	37.21	11.84	12.95	192.86
12	Charles S. Williams	Wisconsin	June 12, 1873	16	9	110.82	19.59	35.74	15.04	11.18	192.37
13	Henry C. Jones	Maine	Sept. 26, 1873	17	1	82.62	30.00	40.89	22.08	14.85	190.44
14	William G. David	New York	Sept. 25, 1873	17	2	97.70	27.81	35.37	15.79	13.14	189.81
15	Omenzo G. Dodge	Kansas	June 13, 1873	17	0	104.92	21.78	34.26	13.97	14.67	189.60
16	Lyman B. Messinger	Massachusetts	Sept. 26, 1872	16	7	104.92	22.05	27.26	22.83	11.10	188.16
17	Edward E. Wright	Massachusetts	Sept. 20, 1873	17	0	76.72	28.36	40.34	20.69	14.60	180.71
18	Arthur W. Dodd	Indiana	June 6, 1873	16	10	99.67	25.34	21.37	18.24	14.06	178.68
19	Benjamin W. Hodges	Mississippi	Sept. 23, 1873	17	5	79.34	28.63	39.05	17.28	14.31	178.61
20	Alfred Jeffries	Texas	June 9, 1873	17	9	92.46	20.14	33.16	16.43	14.79	176.98
21	Selim E. Woodworth	At large	Sept. 30, 1872	15	5	85.90	22.60	33.53	24.00	10.80	176.83
22	Albert Gleaves	Tennessee	June 10, 1873	15	5	90.49	26.16	35.00	12.48	12.35	176.48
23	David W. Jones	Ohio	June 8, 1872	16	7	95.08	17.12	29.11	22.40	11.31	175.02
24	William B. Osterhout	Pennsylvania	June 12, 1872	17	8	101.64	12.74	29.47	18.88	10.88	173.61
25	Albert N. Wood	Indiana	Sept. 24, 1873	16	6	85.90	24.52	36.11	13.76	11.31	171.60
26	James P. Parker	North Carolina	June 6, 1873	17	8	71.48	28.90	36.84	18.88	14.67	170.77
27	Fletcher Hodges	Georgia	June 5, 1872	16	8	82.62	22.33	33.89	19.41	11.84	170.09
28	William Green	Texas	June 13, 1873	15	11	67.54	25.62	37.95	22.40	14.27	167.78
29	Hiero Taylor	Illinois	Sept. 29, 1873	17	0	88.52	23.70	23.95	15.79	12.72	164.68
30	Thomas M. Brumby	Georgia	Sept. 26, 1873	17	10	78.03	23.42	34.63	14.29	14.13	164.50
31	James D. Sheeks	Texas	Sept. 24, 1872	15	0	90.49	15.75	25.05	20.16	(10.47)	161.92
32	Albert W. Grant	Wisconsin	June 9, 1873	17	1	93.77	14.11	24.32	11.84	13.37	157.41
33	Harry W. Dombaugh	Ohio	June 6, 1872	16	4	96.39	16.03	20.63	10.99	12.42	156.46
34	Walter M. Constant	Indiana	June 13, 1873	16	3	73.44	20.96	31.68	14.72	14.10	154.90
35	Keizero Machida	Empire of Japan	Oct. 14, 1873	16	4	102.95	10.27	18.79	(7.79)	11.33	151.13

UNITED STATES NAVAL ACADEMY.

Merit-roll of the Fourth Class, (98 members,) annual examination, May, 1874—Continued.

	Names in order of annual merit.	State.	Date of admission.	Age at date of admission.		Mathematics.	Grammar.	History and Composition.	French.	Conduct.	Aggregate.
				Years.	Months.	120	30	42	24	15	231
36	William S. Benson	Georgia	Sept. 21, 1872	16	11	69.51	22.88	27.63	15.79	13.89	149.70
37	Jonathan K. Brice	Ohio	June 13, 1873	17	8	75.41	23.15	23.58	12.48	11.31	145.93
38	Horace W. Harrison	At large	Sept. 24, 1872	16	9	52.46	24.25	32.42	23.57	10.58	143.28
§ 39	William C. Riorden	Nevada	Sept. 22, 1873	16	9	44.59	28.08	41.63	18.88	(9.86)	143.04
§ 40	Russel C. Paris	New York	Sept. 23, 1873	14	1	80.66	17.67	(11.42)	17.71	14.22	141.68
41	Frank B. Case	Michigan	June 7, 1873	15	7	85.90	14.66	17.32	8.00	12.08	137.96
42	Percival J. Werlich	Wisconsin	June 16, 1873	16	4	65.57	17.95	32.79	8.21	12.15	136.67
43	Frank S. Buckley	Michigan	Sept. 26, 1873	15	11	63.61	21.51	22.47	10.13	13.80	131.52
44	Arthur B. Frenzel	Massachusetts	June 7, 1872	17	7	65.57	11.10	21.00	21.55	(10.32)	129.54
45	Oliver J. Schoolcraft	Virginia	June 5, 1873	17	10	42.62	20.68	30.95	21.12	13.20	128.57
46	William R. Rush	Louisiana	June 6, 1872	14	8	73.44	11.37	16.58	15.79	10.50	127.68
47	Frank R. Heath	At large	Sept. 23, 1873	16	4	55.08	14.38	23.21	20.69	14.28	127.64
48	John H. McNasser	Wyoming Territory	June 8, 1872	15	0	57.05	12.19	24.68	19.41	12.45	125.78
49	Herbert O. Dunn	Rhode Island	June 6, 1873	16	0	49.18	20.41	30.21	11.20	14.18	125.18
50	William L. Burdick	Ohio	Sept. 26, 1873	16	9	52.46	18.22	26.89	13.12	13.37	124.06
51	Henry H. Rogers	Illinois	June 13, 1873	17	9	44.59	24.79	26.53	13.44	14.39	123.74
52	Philip V. Lansdale	At large	June 6, 1873	15	3	59.67	13.84	25.42	9.60	15.00	123.53
53	George W. Denfeld	Massachusetts	Sept. 26, 1873	17	1	60.98	15.21	22.11	11.84	13.35	123.49
54	William F. Endress	New York	Sept. 25, 1873	17	1	46.56	21.23	29.84	10.35	14.67	122.65
55	Thomas B. Maynadier	At large	June 10, 1872	16	9	58.36	10.82	22.84	20.16	(10.31)	122.49
56	Simon Cook	Missouri	June 6, 1873	16	11	69.51	11.92	(13.63)	12.48	14.85	122.39
57	Lewis C. Fletcher	Pennsylvania	June 14, 1873	16	1	62.30	10.55	19.16	14.72	12.65	119.38
58	Harry C. Wakenshaw	New Jersey	June 10, 1873	16	6	38.69	19.86	31.32	14.29	14.18	118.34
‡‡‡ 59	Arthur B. Tracy	New York	June 5, 1873	16	10	(32.13)	18.49	28.37	22.83	14.34	116.16
‡‡‡ 60	Thomas W. Ryan	Pennsylvania	June 13, 1873	16	11	(37.38)	16.85	28.00	21.12	12.74	116.09
61	John C. Wilson	New York	Sept. 25, 1873	16	3	49.18	15.48	16.21	18.45	10.64	109.96
62	Frank W. Toppan	Massachusetts	Sept. 22, 1873	17	9	49.18	14.93	18.42	11.41	14.19	108.13
‡‡‡ 63	Charles N. Atwater	New York	Sept. 24, 1873	16	3	(36.07)	19.32	28.74	9.92	14.01	108.06
‡‡‡ 64	William C. Canfield	At large	Sept. 23, 1873	16	1	(29.51)	18.77	32.05	13.44	13.97	107.74
65	Mark C. Castle	Minnesota	Sept. 29, 1873	16	9	55.08	16.30	15.84	8.43	10.74	106.39
‡‡‡ 66	Austin D. Carrington	Virginia	Sept. 23, 1873	17	5	(30.82)	16.58	21.74	16.43	12.20	97.77
§ 67	Jonathan W. Albertson	North Carolina	June 5, 1872	15	3	(34.10)	11.64	20.26	19.73	11.42	97.15
68	John H. Dykeman	Iowa	June 5, 1873	17	5	40.66	(9.73)	18.05	9.28	12.66	90.38
‡ 69	Benjamin W. Parker	Maine	Sept. 25, 1873	17	0	(40.66)	13.01	15.47	9.60	(10.40)	89.14
‡ 70	George H. Hess	Michigan	Sept. 23, 1873	17	7	(28.20)	10.00	26.16	8.96	12.21	85.53

†	71	Robert P. Fauntleroy	At large	Sept. 23, 1873	16	5	(20.33)	17.40	16.95	15.25	12.09	82.02
†‡	72	Robert K. Wright	Pennsylvania	June 10, 1873	14	8	(24.26)	12.47	19.89	12.91	11.75	81.28
†	73	William Seneerbox	Minnesota	June 5, 1873	16	7	(34.10)	(9.45)	(12.89)	(6.51)	12.41	75.36
†	74	Mariam A. Vinton	At large	June 5, 1873	15	11	(7.21)	13.29	17.68	17.71	14.76	70.65
§	75	Henry B. Lindley	Ohio	June 5, 1873	17	7	(18.36)	13.56	19.53	(7.57)	10.65	69.67
†‡	76	William E. W. Hall	Maryland	June 14, 1873	17	3	(26.89)	(8.90)	(11.79)	10.56	10.86	69.00
§	77	Thomas Dickinson	Kentucky	Sept. 23, 1873	15	5	(9.18)	19.04	14.00	10.77	10.82	63.81
†‡	78	Spencer L. Blodgett	Pennsylvania	Sept. 26, 1873	15	4	(22.95)	(8.36)	(12.16)	(5.44)	13.59	62.50
†‡	79	John G. Mason	Ohio	June 5, 1873	17	6	(25.57)	(7.53)	(11.05)	(4.80)	12.30	61.25
†‡	80	Charles H. Walsh	At large	June 18, 1873	16	4	(5.90)	(9.18)	25.79	(5.65)	13.89	60.41
†	81	Samuel L. Heap	Georgia	Nov. 4, 1872	15	10	(18.36)	(6.99)	14.74	8.96	(10.16)	59.21
†‡	82	John L. Purcell	New Jersey	Sept. 29, 1873	17	4	(16.39)	(8.08)	14.37	(5.87)	14.48	59.19
†‡	83	Wilson L. Todd	Pennsylvania	June 5, 1873	15	1	(21.64)	(7.26)	(9.58)	(7.25)	11.33	57.06
†‡	84	Thomas G. Harkness	Pennsylvania	Apr. 21, 1873	17	11	(14.43)	(6.71)	(10.68)	(4.59)	10.62	47.03
§	85	William K. Stevens	New York	Sept. 29, 1873	16	7	(11.15)	(6.16)	(8.47)	(6.83)	13.80	46.41
§	86	Francis S. Goulding	Pennsylvania	June 7, 1873	17	9	(4.59)	(8.63)	15.11	(4.16)	11.55	44.04
§	87	Ezra P. Sanders	California	Sept. 22, 1873	15	3	(12.46)	(5.62)	(12.53)	8.64	(4.76)	44.01
§	88	Robert M. Donovan	Oregon	June 13, 1873	17	6	(3.28)	(5.89)	(10.32)	(7.25)	10.85	37.59
§	89	Maurice O. Bunn	North Carolina	Sept. 24, 1873	14	10	(9.18)	(7.81)	(9.21)	(6.83)	(4.19)	37.22
§	90	Howard S. Holmes	California	June 5, 1873	17	0	(0.66)	(5.34)	(9.95)	(6.29)	11.03	33.27
§	91	Webster Vinson	At large	Sept. 30, 1873	17	5	(—0.65)	(6.44)	(8.84)	(3.95)	11.72	30.30
§		John Aneona	Pennsylvania	Sept. 20, 1873	17	5	(14.43)	*a*	(13.26)	(5.12)	13.41	.....
†		John D. Chase	Georgia	Sept. 29, 1873	15	11	*a*	*a*	*a*	*a*	13.91	.....
†‡		Baine C. Dent	At large	June 5, 1873	16	7	*a*	*a*	*a*	*a*	10.38	.....
†		Walter C. Hagar	Massachusetts	Oct. 3, 1873	15	10	*a*	*a*	*a*	*a*	14.34	.....
†		John A. Lockwood	Maryland	Sept. 26, 1873	16	10	(—1.95)	*a*	*a*	(6.08)	14.78	.....
†		Richard H. Lull	Illinois	Sept. 23, 1873	16	3	(—3.26)	*a*	*a*	(4.37)	11.49	.....
†		Bushrod W. Taylor	At large	Sept. 20, 1873	14	7	(1.97)	*a*	*a*	(5.12)	14.60	.....

UNITED STATES NAVAL ACADEMY.

Merit-roll of the First Class, Cadet-Engineers, (14 *members,*) *annual examination, May,* 1874, *and general merit-roll for two years.*

	Names in order of general merit.	State.	Date of admission.	Age at date of admission.		Electricity.	Chemistry.	Applied Mathematics.	French.	Applied Mathematics and Mechanics.	Heat.	Steam.	Conduct.	Aggregate for second year.	Aggregate for first year.	Aggregate for two years.
				Years.	Months.	45	99	60	45	60	45	198	150	702	355	1057
*1	**Asa Mattice**	New York	Oct. 1, 1872	19	2	45.00	96.46	60.00	36.00	60.00	45.00	198.00	150.00	690.46	287.52	977.98
*2	**George B. Ransom**	New York	Oct. 1, 1871	20	3	34.09	73.62	30.00	30.00	34.55	18.00	157.38	142.05	519.69	336.06	855.75
*3	**William C. Eaton**	New York	Oct. 1, 1872	21	7	31.36	96.46	50.00	39.00	56.36	42.00	106.61	145.50	567.29	268.60	835.89
*4	**Frank J. Hoffman**	Maryland	Oct. 1, 1872	19	11	42.27	83.77	45.00	45.00	52.73	30.00	147.23	144.90	590.90	240.99	831.89
*5	**Alfred B. Canaga**	Ohio	Oct. 1, 1872	21	9	28.64	88.85	55.00	33.00	49.09	21.00	96.46	150.00	522.04	284.69	806.73
6	Abram V. Zane	Pennsylvania	Oct. 1, 1871	21	1	17.73	43.15	20.00	24.00	30.91	39.00	167.54	140.70	483.03	306.07	789.10
7	John R. Edwards	Pennsylvania	Oct. 1, 1871	18	2	25.91	63.46	40.00	27.00	38.18	33.00	126.92	147.75	502.22	268.99	771.21
8	Benjamin H. Warren	Massachusetts	Oct. 1, 1871	21	7	20.45	78.69	(5.00)	21.00	20.00	27.00	177.69	143.85	493.68	270.07	763.75
9	Albert B. Willitts	Pennsylvania	Oct. 1, 1872	21	6	39.55	58.38	25.00	19.00	41.82	36.00	137.08	147.75	494.58	262.54	757.12
10	Stacy Potts	Pennsylvania	Oct. 1, 1871	18	7	36.82	48.23	35.00	15.00	45.45	24.00	187.85	140.40	532.75	161.28	694.03
†11	Charles Kleckner	Pennsylvania	Oct. 1, 1871	18	7	23.18	68.54	(0.00)	(12.00)	27.27	(6.00)	116.77	145.50	399.26	211.02	610.28
†12	William B. Boggs	District of Columbia	Oct. 1, 1871	19	11	(9.55)	38.08	(—5.00)	42.00	12.73	(12.00)	86.31	144.30	339.97	245.95	585.92
†13	Edgar T. Warburton	Pennsylvania	Oct. 1, 1872	17	3	15.00	33.00	(15.00)	18.00	23.64	(9.00)	66.00	141.45	321.09	186.42	507.51
†14	Frank H. Eldridge	Ohio	Oct. 1, 1872	20	2	(12.27)	53.31	(10.00)	(6.00)	16.36	15.00	76.15	145.05	334.14	162.28	496.42

Merit-roll of the Second Class, Cadet-Engineers, (20 members,) annual examination, May, 1874.

	Names in order of annual merit.	State.	Date of admission.	Age at date of admission.		Mathematics.	Steam.	French.	Conduct.	Aggregate.
				Years.	Months.	150	99	51	55	355
*1	**William R. King**	Maryland	Oct. 1, 1872	19	9	141.67	80.44	43.71	48.13	313.95
*2	**Frank H. Bailey**	Pennsylvania	Oct. 1, 1873	22	3	150.00	99.00	† (7.29)	54.18	310.47
*3	**George S. Willitts**	Pennsylvania	Oct. 1, 1873	20	6	133.33	66.00	46.14	53.30	298.77
*4	**William Cowles**	New York	Oct. 1, 1873	18	7	125.00	90.75	29.14	53.46	298.35
*5	**William L. Cathcart**	Connecticut	Oct. 1, 1873	18	1	100.00	94.88	36.43	53.90	285.21
6	William N. Little	Georgia	Oct. 1, 1872	19	8	108.33	86.63	34.00	47.19	276.15
7	Edward R. Freeman	Mississippi	Oct. 1, 1873	19	9	116.67	53.63	38.86	52.64	261.80
8	Alberto de Ruiz	Pennsylvania	Oct. 1, 1873	20	5	83.33	74.25	51.00	46.20	254.78
9	Walter F. Worthington	Maryland	Oct. 1, 1873	18	6	91.67	57.75	48.57	52.69	250.68
10	Theodore F. Burgdorff	New Jersey	Oct. 1, 1873	18	9	75.00	70.13	41.29	55.00	241.42
11	Edmund U. Loomis	Maryland	Oct. 1, 1872	21	3	50.00	61.88	19.43	53.90	185.21
12	George H. T. Babbitt	Ohio	Oct. 1, 1873	17	2	58.33	45.38	29.14	46.53	179.38
13	Henry H. Stivers	New York	Oct. 1, 1873	18	0	(16.67)	80.44	(14.57)	50.66	162.34
†14	George L. Drouillard	Ohio	Oct. 1, 1872	20	5	66.67	37.13	(9.71)	48.62	162.13
†15	William B. Dunning	New York	Oct. 1, 1873	19	2	(41.67)	49.50	17.00	50.27	158.44
§16	Loring Olmsted	New York	Oct. 1, 1873	18	3	(25.00)	41.25	29.14	44.33	139.72
‡17	Robin J. Reid	Pennsylvania	Oct. 1, 1872	20	2	(33.33)	33.00	21.86	48.79	136.98
§18	Charles N. Johnson	Missouri	Oct. 1, 1873	18	2	0.00	24.75	24.29	50.99	100.03
§19	Gordon H. Claude	Maryland	Oct. 1, 1873	18	11	(8.33)	28.88	(12.14)	44.66	94.01
‡	Harry Eastman	District of Columbia	Oct. 1, 1873	20	9	*a*	*a*	*a*	*a*	*a*

REQUISITES FOR ADMISSION

AND

COURSE OF INSTRUCTION,

WITH

EXAMINATION-PAPERS.

REGULATIONS

GOVERNING

THE ADMISSION OF CANDIDATES INTO THE NAVAL ACADEMY AS CADET-MIDSHIPMEN.

I. The number of Cadet-Midshipmen allowed at the Academy is one for every Member and Delegate of the House of Representatives; one for the District of Columbia; and ten appointed annually at large.

II. The nomination of candidates for admission from the District of Columbia, and at large, is made by the President. The nomination of a candidate from any congressional district or Territory is made on the recommendation of the Member or Delegate from actual residents of his district or Territory.

III. Each year, as soon after the 5th of March as possible, Members and Delegates will be notified in writing of vacancies that may exist in their districts. If such Members or Delegates neglect to recommend candidates by the 1st of July in that year, the Secretary of the Navy is required by law to fill the vacancies existing in districts actually represented in Congress.

IV. The nomination of candidates is made annually between the 5th of March and the 1st of July. Candidates who are nominated in time to enable them to reach the Academy between the 5th and 8th of June will receive permission to present themselves at that time to the Superintendent of the Naval Academy, for examination as to their qualifications for admission. Those who are nominated prior to July 1, but not in time to attend the June examination, will be examined between the 20th and 23d of September following; and should any candidate fail to report, or be found physically or mentally disqualified for admission in June, the Member or Delegate from whose district he was nominated will be notified to recommend another candidate, who shall be examined between the 20th and 23d of September following.

V. No candidate will be admitted into the Naval Academy, unless he shall have passed a satisfactory examination before the Academic Board, and is found, in the opinion of a medical board, to be composed of the surgeon of the Naval Academy and two other medical officers designated by the Secretary of the Navy, in all respects physically sound, well-formed, and of robust constitution, and qualified to endure the arduous labors of an officer in the Navy.

VI. Candidates for appointment as Cadet-Midshipmen must be between fourteen and eighteen years of age when examined for admission. All candidates for admission will be required to certify *on honor* to their precise age, to the Academic Board, previous to examination, and none will be examined who are over or under the prescribed age. They must be of good moral character, satisfactory testimonials of which, from persons of good repute in the neighborhood of their respective residences, must be presented; and testimonials from clergymen and instructors in colleges and high schools will have special weight. They must also pass a satisfactory examination before the Academic Board in reading, writing, spelling, arithmetic, geography, and English grammar, viz: in *reading*, they must read clearly and intelligibly from any English narrative work, as, for example, Bancroft's History of the United States; in *writing* and *spelling*, they must write from dictation, in a legible hand, and spell with correctness, both orally and in writing; in *arithmetic*, they will be examined in numeration, and the addition, subtraction, multiplication, and division of whole numbers and vulgar and decimal fractions, and in proportion, or the rule of three, and show a good knowledge of the subject. It is desirable that the board should ascertain the aptitude of a candidate in this branch of study, which, if good, should count in his favor in case of a slight deficiency in other

branches. In *geography*, candidates will be examined as to the grand divisions, the continents, oceans, and seas, the chief mountains and rivers, and the boundaries and population of the chief nations, their governments, capitals, and chief cities; in *English grammar*, they will be examined as to the parts of speech, the rules connected therewith, and the elementary construction of sentences, and will be required to write such original paragraphs as will show that they have a proper knowledge of the subject.

The board will judge whether the proficiency of the candidate in these branches is sufficient to qualify him to enter upon the studies of the Academy.

VII. Any one of the following conditions will be sufficient to reject a candidate:—

Feeble constitution; permanently impaired general health; decided cachexia; all chronic diseases, or results of injuries that would permanently impair efficiency, viz.,—

1. Infectious disorders.
2. Weak or disordered intellect.
3. Unnatural curvature of spine.
4. Epilepsy, or other convulsions, within five years.
5. Impaired vision, or chronic disease of the organs of vision.
6. Great permanent hardness of hearing, or chronic disease of the ears.
7. Loss or decay of teeth to such an extent as to interfere with digestion and impair health.
8. Impediment of speech to such an extent as to impair efficiency in the performance of duty.
9. Decided indications of liability to pulmonary disease.
10. Permanent inefficiency of either of the extremities.
11. Hernia.
12. Incurable sarcocele, hydrocele, fistula, stricture, or hemorrhoids.
13. Large varicose veins of lower limbs. Chronic ulcers.
14. Attention will also be paid to the stature of the candidate; and no one *manifestly* undersized for his age will be received into the Academy. In case of doubt about the physical condition of the candidate, any marked deviation from the usual standard of height will add materially to the consideration for rejection. Five feet will be the minimum height for the candidate.
15. The board will exercise a proper discretion in the application of the above conditions to each case, rejecting no candidate who is likely to be efficient in the service, and admitting no one who is likely to prove physically inefficient. No candidate rejected by the board will be allowed a re-examination.

VIII. If both these examinations result favorably, the candidate will receive an appointment as a midshipman, become an inmate of the Academy, and be allowed his actual and necessary traveling-expenses from his residence to the Naval Academy, and be required to sign articles by which he will bind himself to serve in the United States Navy eight years, (including his term of probation at the Naval Academy,) unless sooner discharged. If, on the contrary, he shall not pass both of these examinations, he will receive neither an appointment nor his traveling-expenses; nor can he by law have the privilege of another examination for admission to the same class unless recommended by the Academic Board.

IX. When candidates shall have passed the required examinations and been admitted as members of the Academy, they must immediately furnish themselves with the following articles, viz.,—

One parade-suit	$37 72	* One pair low shoes	5 90
One undress-suit	15 79	One pair gymnastic slippers	1 22
One working-suit	3 63	* Eight white shirts	16 00
One overcoat	22 80	* Two night-shirts	3 00
One rubber coat	5 52	* Four undershirts	2 52
One parade-cap	3 95	Twelve linen collars	1 80
One undress-cap	1 75	* Eight pairs socks	2 00
* One pair high shoes	6 25	Four pairs drawers	3 00

*Six handkerchiefs	$2 04	*One tooth-brush	$0 25
*Eight towels	2 00	*One hair-brush	80
Two pairs drill-gloves	1 32	*One whisk	30
Two pairs Lisle-thread gloves	72	*One coarse comb	34
*One pair suspenders	46	*One fine comb	30
One silk handkerchief	77	One mug	13
One neck-tie	84	*One cake soap	10
Two clothes-bags	70	One soap-dish	14
One hair mattress	10 71	One requisition-book	44
One straw mattress	1 58	One laundry-book	48
One hair pillow	1 58	One pass-book	47
One pair blankets	4 12	One stencil and ink	23
Two bed-spreads	2 84	*One thread and needle-case	53
Six sheets	5 25	One rug	1 86
Four pillow-cases	1 24	One wash-basin	1 36

Room-mates will procure for their common use—

One looking-glass, (half-cost)	$0 75	One broom, (half-cost)	$0 20
One water-pail, (half-cost)	53	One table-cover, (half-cost)	75
One slop-bucket, (half-cost)	66		
Total			179 64

The articles marked *, not being required to conform to a standard pattern, may be brought by the Cadet from his home, but all other articles must conform to the regulations, and are therefore required to be supplied by the Store-keeper.

X. Each cadet-midshipman must, on admission, deposit with the paymaster the sum of $100, for which he will be credited on the books of that officer, to be expended, by direction of the Superintendent, for the purchase of text-books and other authorized articles besides those enumerated in the preceding article.

All the deposits for clothing, and the entrance-deposit of one hundred dollars, must be made before a candidate can be received into the Academy.

SUMMARY OF EXPENSES.

Deposit for clothing	$179 64
Deposit for books, &c	100 00
Total deposit required	279 64

The value of clothing brought from home is to be deducted from this amount.

Each cadet-midshipman, one month after admission, will be credited with the amount of his actual expenses in traveling from his home to the Academy.

XI. A cadet-midshipman found deficient at any examination cannot, by law, be continued at the Academy or in the service, unless upon the recommendation of the Academic Board, and it will be useless to apply to the Secretary of the Navy, who will decline to interfere in the matter.

XII. A cadet-midshipman who voluntarily resigns his appointment within a year of the time of his admission to the Academy will be required to refund the amount paid him for traveling-expenses.

A sound body and healthy constitution, good mental abilities, a natural aptitude for study and habits of application, persistent effort, an obedient and orderly disposition, and correct moral principles and deportment, are so necessary to success in pursuing the course at the Academy, that persons conscious of any deficiency in these respects are earnestly recommended not to subject themselves or their friends to the mortification and disappointment consequent upon failure, by accepting appointments and attempting to enter a service for which they are not fitted.

GEO. M. ROBESON,
Secretary of the Navy.

GENERAL CHARACTER OF THE QUESTIONS PROPOSED AT THE EXAMINATION OF CANDIDATES FOR ADMISSION TO THE UNITED STATES NAVAL ACADEMY AS CADET-MIDSHIPMEN.

ARITHMETIC.

NOTATION AND NUMERATION.—The candidate is required to express in figures any whole number, decimal, or mixed number, to write in words any given number, and to explain the Roman and Arabic systems of notation.

DENOMINATE NUMBERS.—The tables of money, weights, and measures in common use, including English money; addition, subtraction, multiplication, and division of denominate numbers; the relation existing between the troy and avoirdupois pound; number of cubic inches in a gallon; reduction of differences of longitude to their equivalents in time, and *vice versa*.

FRACTIONS.—The candidate must be familiar with all the processes of common and decimal fractions, and is expected to be able to give clearly the reasons for such processes, and to be familiar with the contracted methods of multiplication and division given in the ordinary text-books on arithmetic.

PROPERTIES OF NUMBERS.—Test of divisibility of numbers by 2, 3, 5, 8, 9, 11, 25, 125, &c.; the resolution of composite numbers into prime factors; the method of determining whether any number is prime or composite, and of finding the greatest common divisor and the least common multiple of large as well as small numbers.

RATIO AND PROPORTION.—Definitions, and explanations of the nature of ratio and proportion; different methods of writing a proportion; solution of problems in simple and compound proportion.

ANALYSIS.—Miscellaneous problems, usually classed under the head of analysis, or mental arithmetic.

The candidate will be required to perform examples under any or all of the above heads. Questions are to be answered first in writing, and if the written examination is not decisive, an oral examination is added.

GEOGRAPHY.

Candidates will be questioned on,—

The grand divisions of the land and water; the character of coast-lines; the direction and position of mountain-chains, and the locality of important peaks; the position and course of rivers, their tributaries, and the bodies of water into which they empty; the position of important seas, bays, gulfs, and arms of the sea; the political divisions of the land, their position, boundaries, and capital cities; the position and direction of great peninsulas, and the situation of important and prominent capes; straits, sounds, channels, and the most important canals; great lakes and inland seas; position and political connection of important islands and colonial possessions; locality of cities of historical, political, or commercial importance; (attention is specially called to the rivers and bodies of water on which cities are situated;) the course of a vessel in making a voyage between wellknown sea-ports.

GRAMMAR.

Candidates will be examined in the whole of English grammar, as treated in the common-school text-books, embracing the following subjects: The divisions of letters, and the use of capitals; the parts of speech; the classification of *nouns*, and the distinctions of person, gender, and number; under *gender*, the three ways of distinguishing sex; under *number*, the rules for the formation of the plural, nouns irregular and defective

in number, the plural of proper names; under *case*, the different uses of the three cases, the rules for inflection, the changes in ending to denote case; the difference between the definite and indefinite *article*, and the use of *a* or *an;* the classification of *adjectives;* the explanation of the different degrees of comparison; the rules for comparing adjectives; irregular and defective comparison; numerals and their classification; the double classification of *pronouns*, first, into substantives and adjectives, secondly, into personals, relatives, &c.; peculiarities in the use of personal pronouns, as, the difference between *my* and *mine*, between *thou* and *you*, and the various uses of *it;* compound personal pronouns; the double office of relatives, and the different classes of objects to which each of them is applied; compound relative pronouns; interrogative pronouns; adjective pronouns, or pronominal adjectives, and their classification; the classification and conjugation of *verbs;* the relations between transitive and intransitive verbs; the principal parts of regular, irregular, and defective verbs; the uses and inflexion of auxiliaries; the essential peculiarities in the use of voice, mood, tense, number, and person; tense endings and personal endings; impersonal verbs; the classification, formation, and comparison of *adverbs;* conjunctive adverbs; the use of *prepositions, interjections*, and *conjunctions*, with the classification of the latter.

The rules for the construction and arrangement of words and sentences, given under syntax.

Parsing, according to the following model:

NOUN: Class, gender, number, person, case.

ARTICLE: Definite or indefinite; qualified noun.

ADJECTIVE: Class; compared or not compared; comparison, if admitting it; degree of comparison; qualified noun.

PERSONAL PRONOUN: Person, gender, number, case.

RELATIVE PRONOUN: Person, gender, number, case, antecedent.

INTERROGATIVE PRONOUN: Gender, number, case.

ADJECTIVE PRONOUN, (or pronominal adjective): Class; qualified word.

VERB: Class, form, principal parts, tense, mood, voice, person, number, subject.

ADVERB: Class; derivation and comparison, if derived and compared; qualified word.

PREPOSITION: Words between which the relation is shown by the preposition.

INTERJECTION: The kind of emotion expressed.

CONJUNCTION: Class; words or sentences connected.

The construction of the word will be required in all cases.

READING.

Candidates will be examined in reading aloud English prose, in a standard work; for example, Bancroft's History of the United States.

WRITING AND SPELLING.

Candidates will be required to write a short original letter, and an exercise in dictation, and to spell twenty-four words in common use. An exercise containing less than eight mistakes in spelling will be considered satisfactory in this respect.

The following words were given in June, 1874:

Engineer.	Physician.	Necessary.	Referred.
Artillery.	Exquisite.	Delegate.	Sympathy.
Beautify.	Photograph.	Militia.	Excellent.
Linen.	Colonel.	Chemistry.	Essential.
Auxiliary.	Emphasis.	Parallel.	Splendor.
Malicious.	Academy.	Judicious.	Trustworthy.

If the written examination is not decisive, an oral examination is added.

Time allowed for examination in English branches, three hours.

ARITHMETIC.

JUNE 8, 1874.—*Time allowed, five hours.*

N. B.—The starred questions are not required, but any one or all of them may be substituted for an equal number of the first ten questions.

1. Reduce $\frac{1110001}{9910000}$ to a decimal. Reduce 0.001264 to a common fraction in its lowest terms. Divide 0.00041097 by 2163. Divide 547723 by 0.000493. Reduce $\frac{277775}{5500000}$ to a decimal.

2. Reduce the following expression to its simplest form—

$$\frac{4\frac{1}{2} + \frac{3\frac{1}{3}}{5} - \frac{9}{13} + \frac{\frac{6}{7}}{1\frac{5}{21}}}{2\frac{1}{6} \text{ of } 2\frac{1}{2} - 3\frac{1}{7} + \frac{3}{2} \text{ of } 1\frac{13}{14}} + 1\frac{2}{3} + \frac{12}{5} \text{ of } \frac{7}{2} - 9\frac{1}{15}$$

3. Find the value of 0.074609375 of £10 13*s.* 4*d.*

4. Resolve each of the following numbers into its prime factors: 1001, 3135, 1183, and 529. How can we determine by inspection whether a number is exactly divisible by 3, 5, 9, 25, or 125? Express the decimal 0.428571428571 as a common fraction.

5. Sound travels at the rate of 1142 feet per second. If a gun be fired at a distance of $4\frac{1}{2}$ miles, how long after the flash will the sound be heard?

6. Six thousand eight hundred dollars is divided between A, B, and C, so that A's share is $\frac{2}{3}$ of B's, and B's share is $\frac{3}{5}$ of C's; how much does each receive?

7. A city lot, 50 feet by 75 feet, is sold for $7500.00; how much does it cost per acre?

8. A contractor has a piece of work which must be done in 18 days, and can be done in this time by 160 men, whom he has in his employ, working 10 hours a day. After working 6 days, they strike for 8 hours as a day's work. After 2 days the contractor yields; how many more men must he employ that the work may be finished in 18 days from the beginning, the new men also working 8 hours a day?

9. Suppose the alloy in a silver dollar to be $\frac{1}{10}$ of its mass, and the coin to be worth five cents if it were all alloy, what would be its value if it were all pure silver?

10. A train 88 yards in length overtook a person walking along the line at the rate of 4 miles an hour, and passed him in 10 seconds. Twenty minutes after, the train overtook another person, and passed him in 9 seconds. When did the first person overtake the last?

1*. Extract the square root of 0.049. Simplify—

$$16 - \{5 - 2x - [1 - (3 - x)]\}$$

What are the factors of $4a^2 - 9c^2$? of $x^2 + 9x + 20$? of $x^3 + 8$?

2*. Solve the equation—

$$\frac{x-1}{4} - \frac{x-5}{32} + \frac{15-2x}{40} = \frac{9-x}{2} - \frac{7}{8}$$

Multiply— $x^{2n+1} + y^{2n-1}$ by $x^{2n-1} + y^{2n+1}$

3*. Simplify—

$$\frac{x-a}{x - \frac{(x-b)(x-c)}{x+a}}$$

Solve the equation— $\sqrt{x} + \sqrt{x-16} = 8$

GRAMMAR.

JUNE 13, 1874.

1. Name the three cases, and explain the different uses of each.

2. Define *gender, infinitive mood, etymology, transitive verb.*

3. Name the auxiliaries, and show in what way each one modifies the meaning o the verb.

4. Give the principal parts of the following verbs: *Ride, drown, lay, shake, slay, spread.*

5. Compare *least, more, near, shy.*

6. Decline *calf, hero, chimney.*

7. Give the plural of *court-martial*, of *man-servant*, of *focus.*

Give the feminine of *hero, hunter, executor.*

8. Parse: "As a matter of course, forgetting for the moment all his anxiety, he instantly started in pursuit."

GEOGRAPHY.

JUNE 13, 1874.

1. Name and describe the four chief rivers of France, telling where they rise, in what direction they flow, and into what water they empty.

2. Where is Singapore? Vera Cruz? Barcelona? Prague? Natal?

3. Fix the position of the following mountains, and state to what range each one belongs: (1) Mount Saint Elias, (2) Elburz, (3) Chimborazo, (4) Mount Washington.

4. Name in order the bodies of water through which you would pass in sailing from Bombay to Saint Petersburg.

5. Where is the Bay of Fundy? The Gulf of Guinea? The Sea of Azov? Lake Balkash? Lake Pontchartrain?

6. What bodies of water are connected, and what bodies of land are separated, by the following: (1) Saint Clair River, (2) Rio de la Plata, (3) Dardanelles, (4) Straits of Mackinaw?

7. Fix the position of the following, and tell which, if any, are capitals of States, and of what States they are the capitals: (1) Saint Paul, (2) Saint Petersburg, (3) San Francisco, (4) Saint Louis, (5) Santiago.

8. Name the capital of each of the following States, and tell on what river it is situated: (1) Alabama, (2) Tennessee, (3) Kentucky, (4) Iowa, (5) Paraguay, (6) Hindostan, (7) Italy.

ARITHMETIC.

JUNE 15, 1874.—*Time allowed, five hours.*

Questions 1*, 2*, and 3* are not required, but any one or all of them may be substituted for an equal number of the first ten questions.

1. Divide 27.18 by one hundred and fifty-one ten billionths, and write the result in words. Reduce $\frac{2368}{512000000}$ to a decimal. Find what decimal 3.3 feet is of a mile.

2. Subtract $\frac{1}{3}$ of $\frac{3\frac{3}{8}}{\frac{1}{4}\text{ of }33\frac{3}{4}} + \frac{1}{2}$ of $\frac{\frac{3}{4}}{1+\frac{9}{16}} + \frac{\frac{3}{5}\text{ of }\frac{1}{12}}{\frac{7}{9}\text{ of }7\frac{5}{7}}$ from 101 times the sum of $\frac{1}{8}$, and $\frac{1}{2}$ of $\frac{7}{15}$ of $\frac{7}{20}$.

3. Express $\frac{7\frac{2}{4}-3\frac{11}{12}}{18\frac{1}{2}\text{ of }\frac{6}{7}}$ of £33 14*s.* $5\frac{3}{4}$*d.* as a fraction of £157 17*s.* $8\frac{1}{2}$*d.*

4. Find the number of acres in a piece of ground 1 fur. 20 rds. long, and 12 rds. 4 yds. 1 ft. 2.4 in. wide.

5. An elastic ball after striking the ground rises to $\frac{4}{7}$ of the height from which it falls. After striking the ground the third time it rises $3\frac{7}{8}$ inches. From what height did it fall at first?

6. Two boats row a race over a straight course 1 mile 995 yds. long, their rates of speed being 12 miles and $11\frac{2}{29}$ miles per hour respectively. Assuming that sound travels at the rate of 1140 feet per second, find how much the faster boat will be ahead of the other when the sound of the gun fired at starting is heard at the winning post.

7. A does $\frac{2}{3}$ of a piece of work in 4 hours, B does $\frac{2}{5}$ of what remains in 1 hour, and C finishes it in 20 minutes. How long would they have been doing the work if they had worked together?

8. A clock which was $1\frac{1}{9}$ minutes fast at a quarter to 11 p. m. on June 10, was 8 minutes slow at 9 a. m. June 15. When was it exactly right?

9. A ditch is being dug at the rate of 81 feet per day by 54 men. After 13 days work 8 of them are replaced by boys, and the work goes on for 11 days more, at the end of which time the whole length dug is 1889 feet. What length of the ditch does each boy dig in a day?

10. Three men are employed in a work, working respectively 8, 9, and 10 hours a day, and receiving the same daily wages. After 3 days, each works an hour a day more, and the work is completed in 3 days more. If the total sum paid for the wages be $22.81, how much should each receive?

1*. Write the factors of $a^2c - cd^2$, of $x^2 - 7x + 12$.

Multiply $x^{a-2b} + y^{2b-a}$ by $x^{2b-a} - y^{a-2b}$.

2*. Simplify the expression $\dfrac{\frac{x}{xy} + \frac{y}{x+y}}{\frac{x}{x-y} - \frac{y}{x+y}}$.

Multiply $2 + \sqrt{3}$ by $2 - \sqrt{3}$.

3*. Solve the equation $\dfrac{x-a}{a-b} - \dfrac{x+a}{a+b} = \dfrac{2ax}{a^2 - b^2}$.

Find the value of $(64)^{-\frac{1}{6}}$, and $\left\{[16]^{\frac{1}{4}}\right\}^{-3}$.

GRAMMAR.

JUNE 16, 1874.

1. Decline (or inflect) *cargo, valley, wife.*
2. Compare *queenly, dry, gay, better.*
3. Give the principal parts of *abide, choose, let, lay, burst.*
4. What is an *irregular verb?* A *participle?* An *ordinal?* A *personal pronoun?*
5. What verbs have distinction of voice?
6. What classes of nouns are used in the singular only?
   Give the plural of *bandit, court-martial, talisman, memorandum, echo.*
7. Decline all the personal pronouns in the singular.
8. Parse: "A daily increasing want of something better was felt by the public."

GEOGRAPHY.

JUNE 16, 1874.

1. Name five tributaries of the Mississippi River, telling where they rise, in what direction and through what States they flow, and into what water they empty.

2. Name, in order, the European states having any sea-coast, giving the capital of each, and the water on or near which it is situated.

3. Where is Melbourne? Hamburg? Batavia? Callao? Galveston? Monrovia?

4. Make a coasting voyage from Alexandria to Singapore; state what waters you pass through, and what countries you coast along, in order.

5. Give the position of the following, and state to what country each belongs: (1) Azores; (2) Vancouver's Island; (3) Channel Islands; (4) Ceylon; (5) Martinique; (6) Santa Cruz.

6. State in what country each of the following capes is situated, and into what water it projects: (1) St. Vincent; (2) San Roque; (3) San Blas; (4) Cape Clear.

7. Give the position and extent of the following ranges: (1) Cevennes; (2) Blue Ridge; (3) Jura; (4) Hindu-Koosh.

8. Fix the position of the six largest towns in the United States, and designate which, if any, are capitals of States.

REGULATIONS

GOVERNING THE

APPOINTMENT OF CADET-ENGINEERS IN THE NAVY.

I. In pursuance of the third and fourth sections of an act, passed at the first session of the Thirty-eighth Congress, approved July 4, 1864, "*To authorize the Secretary of the Navy to provide for the education of naval constructors and engineers, and for other purposes,*" and of the second section of an act, passed at the first session of the Thirty-ninth Congress, approved March 2, 1867, entitled "*An act to amend certain acts in relation to the Navy,*" applications will be received by the Navy Department for the appointment of Cadet-Engineers.

II. The application is to be addressed to the Secretary of the Navy, and can be made by the candidate, or by any person for him, and his name will be placed on the register. The registry of a name, however, gives no assurance of an appointment, and no preference will be given in the selection to priority of application.

III. By an act, passed at the first session of the Forty-third Congress, approved June 22, 1874, the number of annual appointments of Cadet-Engineers is limited to twenty-five. The candidate must not be less than sixteen nor more than twenty years of age; he will be required to certify, *on honor*, to his precise age, to the Academic Board, previous to his examination, and no one will be examined who is over or under the prescribed age. His application must be accompanied by satisfactory evidence of moral character and health, with information regarding date of birth and educational advantages hitherto enjoyed. Candidates who receive permission will present themselves to the Superintendent of the Naval Academy on the 15th of September, for examination as to their qualifications for admission.

IV. The course of study will comprise four academic years. The pay of a Cadet-Engineer is the same as that of a Cadet-Midshipman.

V. The academic examination previous to appointment will be competitive and will be on the following subjects, namely: Arithmetic; Algebra, through equations of the first degree; Plane Geometry; Rudimentary Natural Philosophy; Reading; Writing; Spelling; English grammar; English composition; and Geography. The candidate will also be required to exhibit a fair degree of proficiency in pencil-sketching, and to produce satisfactory evidence of mechanical aptitude. Candidates who possess the greatest skill and experience in the practical knowledge of machinery, *other qualifications being equal,* shall have precedence for admission.

The other requisites and conditions are the same as those of Cadet-Midshipmen.

COMPETITIVE EXAMINATION OF CANDIDATES FOR APPOINTMENT AS CADET-ENGINEERS, SEPTEMBER, 1874.

ARITHMETIC.

Time allowed, three hours.

1. Reduce $\frac{1110001}{9910000000}$ to a decimal. Reduce .001264 to a common fraction in its lowest terms. Divide .00041097 by 2163. Reduce $\frac{27775}{5000000}$ to a decimal. Divide 547723 by .000493.

2. Subtract $\frac{1}{3}$ of $\frac{3\frac{3}{5}}{\frac{1}{4}\text{ of }33\frac{3}{4}} + \frac{1}{2}$ of $\frac{\frac{3}{4}}{1+\frac{9}{16}} + \frac{\frac{3}{5}\text{ of }\frac{1}{12}}{\frac{7}{9}\text{ of }7\frac{5}{7}}$ from 101 times the sum of $\frac{1}{3}$, and $\frac{1}{2}$ of $\frac{7}{15}$ of $\frac{7}{20}$. Of the fractions $\frac{1}{21}$ of $2\frac{1}{2}$, $\frac{1}{24}$ of $3\frac{1}{3}$, and $\frac{1}{28}$ of $4\frac{5}{24}$; divide the sum of the greatest and least by the intermediate one.

3. Find the value to five places of decimals of $\sqrt[3]{.27} - \sqrt{.4}$.

4. If the weight of a cubic foot of water is 62.35 pounds avoirdupois, what is the error in calculating the weight of 1000 cubic feet on the supposition that a cubic fathom weighs 6 tons 1440 pounds?

5. If the price of candles $8\frac{1}{2}$ inches long be $37\frac{1}{2}$ cents per dozen, and that of candles of the same thickness and quality $10\frac{1}{4}$ inches long be 50 cents per dozen, which kind do you advise a person to buy? What would be the saving per cent. should your advice be followed?

6. A contractor employs a fixed number of men to complete a work. He may employ either of two kinds of workmen, the first at $6.36 per week each, the second at $4.44 per week each; the work of one of the former being to that of one of the latter as 5 to 4. If he finishes it as quickly as possible, he spends $1296 more than he would have done if he had finished it as cheaply as possible, but takes 4 weeks less time. What would it have cost if he had employed equal numbers of the two kinds of workmen?

GEOMETRY.

Time allowed, one hour.

1. Define *angle, right angle, perpendicular.* What is the complement of an angle? The supplement? Prove that the three angles of any plane triangle are together equal to two right angles, and that either exterior angle is equal to the sum of the two opposite interior angles.

2. What is *a straight line? A plane surface?* Prove that if a straight line drawn parallel to the base of a triangle bisects one of the sides it bisects the other side also, and is equal in length to one-half the base.

3. State how triangles, quadrilaterals, and parallelograms are classified. Define each class, and illustrate by diagrams.

ALGEBRA.

Time allowed, three hours.

1. Separate each of the following quantities into its simplest factors:
$x^3 + 27$, $x^2 + 2x - 3$, $2a^2 - \frac{1}{2}$, and $4a^2b^2 - (a^2 + b^2 - c^2)^2$. Show what is meant by a^{-m}, and by a^0. Multiply $x^{a-b} + y^{b-a}$ by $x^{b-a} - y^{a-b}$.

2. Divide $x^6 - 8x^4 + 3x^3 - x + 18$ by $x^3 - x^2 - x - 1$, giving quotient and remainder.

Find the value of the fraction—

$\frac{x^2 - 7x + 12}{x^2 - 8x + 15}$ when $x = 0$, when $x = 3$, when $x = 4$, and when $x = 5$. What is the value of $\frac{m\,(m-1)\,(m-2)}{m^3}$ when m is indefinitely great?

3. Simplify the expressions—

$$\left.\frac{\frac{1}{a} + \frac{1}{b+c}}{\frac{1}{a} - \frac{1}{b+c}}\right\} 1 + \frac{b^2 + c^2 - a^2}{2bc}\left.\right\}, \text{ and } \frac{3+2x}{2-x} - \frac{2-3x}{2+x} + \frac{16 - x^2}{x^2 - 4}.$$

4. Solve the equation—

$$12x - \frac{.18x - .05}{.5} = .4x +$$

Find x and y from the equations—

$$ax = by, \text{ and } x + y = c.$$

5. A's horse can trot a miles in b minutes; B's horse can trot c miles in d minutes. Find the greatest number of yards start that A can give B in a race of e miles.

GRAMMAR.

Time allowed, two hours.

1. Decline (or inflect) *chimney, commander-in-chief, cargo, wife.*

2. What is a transitive verb? A participle? An ordinal? A personal pronoun? An impersonal verb?

3. Give the principal parts of *abide, ring, strive, lay, lie, sit, set.*

4. Give the plural of *calf, hero, talisman, court-martial.*

5. Give the feminine of *hero, hunter, executor.* Name the relative pronouns, and state the classes of objects to which they may be applied.

6. How does the potential mood represent a fact? What tenses has this mood? Give the first person singular of the verb *to lay* in each of the tenses of this mood.

7. Compare *many, cleanly, little, elder, next,* without using adverbs.

8. Parse the words in italics in the following sentence: "*Even now there was some trouble; for I was put in* by the queen, and the *people* knew *nothing* of me, and *did all that* lay in their power *to keep* me *out.*"

SPELLING.

Responsible.	Nuisance.	Relic.	Guerilla.
Ridicule.	Vengeance.	Linear.	Consequence.
Tragedy.	Sympathetic.	Melancholy.	Hopelessness.
Mechanic.	Covenant.	Artillery.	Recompense.
Cashier.	Felicity.	Extraordinary.	Shrewd.
Exaggerate.	Machinery.	Necessary.	Despicable.

GEOGRAPHY.

Time allowed, one hour.

1. Where is Melbourne? Stettin? Galveston? Monrovia? Singapore? Trieste?

2. Describe the following rivers, telling where they rise, in what direction they flow, and into what water they empty: (1) Loire, (2) Cumberland, (3) Niger, (4) Irrawaddy, (5) Vistula.

3. Bound Kansas.

4. Name the body of water on which each of the following cities is situated: (1) Charleston, (2) Genoa, (3) Lisbon, (4) Calcutta, (5) Montevideo. Tell which, if any, are capitals of States.

5. Name the peninsulas of Europe, and tell in each case the inclosing bodies of water.

6. Make a voyage from the head of Lake Superior to Pittsburgh.

7. Where is Mount Chimborazo? Mount Hecla? Cevennes Mountains? Blue Ridge? What is the great mountain-range of Mexico?

8. Where is Cape Mendocino? Cape Canaveral? Cape Bon? Cape Henlopen? Cape Gallinas?

Candidates will be required to write a short original letter, and an exercise in dictation.

RUDIMENTARY NATURAL PHILOSOPHY.

Time allowed, two hours.

1. Define *centre of gravity; mass of a body; moment of a force; relative rest*, and *relative motion*. If the velocity of a moving body increase uniformly, what can be inferred in regard to the force acting upon it? What can be inferred if the velocity is uniform?

2. Define specific gravity. Can the pressure of a fluid on the bottom of a vessel containing it exceed the entire weight of the fluid? Give an explanation. How can the heat of steam be made to exceed 212° Fahrenheit?

3 A bottle, in the shape of a quadrangular pyramid, 3 inches square at the base and 7 inches in height, is filled with mercury, weighing 8 ounces per cubic inch; find the pressure on the bottom of the bottle.

4. At one end of a lever 20 inches in length, a weight of 4 pounds is placed, and is balanced by a weight at the other end; the sum of the weights, together with the pressure on the fulcrum, being 30 pounds, find the weight and its distance from the fulcrum.

5. A uniform cube floating in water sustains two weights of 8 pounds and 20 pounds, respectively, so placed as to keep one of its faces horizontal; the first being placed at a corner of the face, find the position of the other, the diagonal of the face being 10 inches.

6. Draw a diagram showing the construction of the common pump, and explain briefly the uses of the essential parts.

If a siphon be used for drawing off mercury, what is the greatest height at which the bend may be placed?

7. *Temperate* is marked on Fahrenheit's thermometer at 56°; find the corresponding number of degrees on the centigrade thermometer.

8. If 9 cubic feet of a certain substance weigh 1000 pounds, find its specific gravity.

COURSE OF INSTRUCTION FOR CADET-MIDSHIPMEN.

DEPARTMENT OF SEAMANSHIP.

SEAMANSHIP.—Description of all kinds of rope, and its practical manipulation for all purposes on shipboard; measuring for and fitting standing and running rigging; masting, sparring, and rigging ship; getting on board and stowing a vessel's outfit; organizing a ship's company; fittings of boats; management of boats under all circumstances; evolutions of vessels at sea and in harbor; repair of spars and rigging in cases of accident; duties of officers at sea and in port; rules of the road; wind and weather.

Text-book.—Luce's Seamanship, with lectures and illustrations from models.

SHIP-BUILDING.—The building, launching, and docking of ships; description and construction of docks; boat-building.

Text-book.—Wilson's Ship-Building, with lectures illustrated by models and drawings.

NAVAL TACTICS.—Organization, formations, and manœuvering of a fleet, under steam or sail.

Text-books.—Manual of Naval Tactics, (Ward); Steam Fleet Tactics, (Parker); United States Naval Signal-Book; Manual of Signals, (Myer).

PRACTICAL EXERCISES, consisting of—

SEAMANSHIP DRILLS.—Exercises on shipboard, with sails and spars.

NAVAL TACTICS.—Exercises in boats, under oars and under sails.

SIGNALS.—Exercises in the use of signals according to Myer's Army Signal-Code.

Instruction in boxing, gymnastics, swimming, and dancing is in charge of this department.

DEPARTMENT OF ORDNANCE AND GUNNERY.

PRACTICE AND THEORY OF GUNNERY.—*Practical Naval Gunnery*, as laid down in the Ordnance and Gunnery Instructions for the United States Navy.

Preparation of gun-iron from crude ore, including the description and use of furnaces. Manufacture of wrought-iron, steel, and bronze. Fabrication of guns of all descriptions. Manufacture of gunpowder and fuses, and of all kinds of projectiles and fireworks.

Theory of gunnery.—Motion of projectiles *in vacuo* and in the atmosphere; initial, remaining, and final velocities, and the methods of determining their values; the effects of variations of charge, windage, and weight of projectiles; deviation of projectiles; the several systems of pointing; tangent-sights and determination of their values; penetration and shock of projectiles, and recoil of guns.

Text-books.—Cooke's Naval Ordnance and Gunnery; Ordnance Instructions, United States Navy; Gunnery Instructions, United States Navy.

INFANTRY TACTICS.—Organization and formation of squad, company, and battalion; school of the soldier; company and battalion drill, including instructions for skirmishers and the bayonet-exercise.

Text-book.—United States Infantry Tactics.

PRACTICAL EXERCISES, consisting of—

INFANTRY-DRILL.

FIELD-ARTILLERY AND BOAT-HOWITZER EXERCISE.

GREAT GUNS.—Exercises and target-practice on board the United States steamer Santee.

MORTAR-PRACTICE.

FENCING.—Exercise with small swords and broadswords.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.—Fundamental operations; reduction and solution of equations of the first and second degrees; reduction and transformation of surd quantities; proportions and progressions; summation of series; nature and construction of logarithms, and theory of equations.

GEOMETRY.—Plane and solid.

TRIGONOMETRY.—Analytical investigation of trigonometrical formulæ, and their application to the solution of all the cases of plane and spherical trigonometry; the construction and use of trigonometrical tables.

APPLICATION OF ALGEBRA AND TRIGONOMETRY.—Mensuration of planes and solids.

DESCRIPTIVE GEOMETRY.—The graphic illustration and solution of problems in solid geometry, and the applications of this method, particularly to the projections of the sphere.

ANALYTICAL GEOMETRY.—Equations of the right line, plane and conic sections; discussion of general equations of the second degree, involving two or three variables; determination of loci; principal problems relating to the cylinder, cone, sphere, and spheroids.

Text-books.—Ray's Higher Algebra; Chauvenet's Geometry; Chauvenet's Trigonometry; Church's Descriptive Geometry; Johnson's Analytical Geometry; Bowditch's Useful Tables.

DEPARTMENT OF STEAM-ENGINERY.

ENGINES.—The classification of marine steam-engines, with their varieties of arrangement. The study of details, and of the instruments and apparatus used in marine-service in connection with steam-engines. The varieties of valve-gear, of steam-generators, of propelling-instruments, condensers, distillers, and pumps. The principles followed to insure strength in construction.

PRACTICAL EXERCISES.—The management of engines and boilers in operation. The care, preservation, and adjustment of marine-engines. The use of fuel. The use of the indicator and the interpretation of indicator diagrams. Methods of computing the power and the evaporation, and of determining the incidental losses incurred at sea, which affect the power. The duties of the engine-room watch; the arrangement and disposition of the engineer force on shipboard.

Text-books.—Bourne's Catechism of the Steam-Engine; King's Practical Notes on the Steam-Engine.

DEPARTMENT OF ASTRONOMY, NAVIGATION, AND SURVEYING.

ASTRONOMY.—*Descriptive and physical astronomy.*—Description of the solar system; figure and magnitude of the earth, its motions and consequent changes of seasons; length of day and night; trade and periodical winds; nature and effect of parallax, refraction, dip of the horizon, precession, nutation, and aberration; theory of gravitation; Kepler's laws; explanation of the apparent motions of the sun, moon, planets, and comets, and the principles upon which the determination of their orbits depends; the moon's motions and phases; general theory of the tides; theory of eclipses; general description of the stars, and their distribution in space; measures of time; equation of time. *Practical astronomy.*—The use of astronomical instruments in determining the positions of celestial objects, and terrestrial latitudes and longitudes; optical principles involved in the construction of astronomical instruments, and in the theory of astronomical refraction. Calculation of eclipses and occultations.

NAVIGATION.—Sailing by compass; sailing on a great circle; various methods of finding a ship's place at sea; construction and use of charts, including topographical and hydrographic drawing; principles and use of the sextant and circle of reflection, and application of the glass prism to these instruments; the artificial horizon; the azimuth compass; methods of ascertaining the deviation of the compass, produced by

local attraction on shipboard; the log and other instruments for determining a ship's rate of sailing; sounding-instruments; nature and use of the Nautical Almanac; relations of time under different meridians; computation of altitudes and azimuths of celestial objects; finding, by means of amplitudes and azimuths, the variation of the compass; finding the latitude by meridian observations of the sun, moon, planets, and stars; by observations near the meridian, by single altitudes at a given time, and by two altitudes of the same or different objects; finding the longitude by the chronometer, by lunar distances, and by altitudes of the moon; Sumner's method of finding a line of position, and determining the ship's place by two such lines; rating a chronometer on shore by single altitudes, and by equal altitudes, and finding its error at sea by a series of lunar observations. Theory of the various problems of navigation and nautical astronomy, and the application of spherical trigonometry to their solution. Consideration of the true figure of the earth, and the corrections in nautical problems depending upon it.

Surveying.—Its principles and practice; measurement of heights and distances; leveling; trigonometrical surveying; hydrographical surveying; direct measurement of a base-line; measurement by sound; running lines of soundings; reduction for tides; survey of a harbor or river; fixing the position of shoals; running survey of a coast; geodetic corrections in extended surveys; application of astronomical observations for azimuth, latitude, and longitude.

Text-books.—C. J. White's Astronomy; Jeffers's Marine Surveying; Coffin's Navigation.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

The differential and integral calculus.—The principles of the Differential Calculus, including Taylor's theorem, and applications to problems of maxima and minima, and the tracing of curves; the Methods of Integration, and the application of the Integral Calculus to areas, surfaces, and volumes, and to the finding of centres of gravity and moments of inertia, and to the simpler cases of differential equations.

Mechanics.—*Statics*, including the theory of friction, adhesion, and stiffness of cordage. *Dynamics*, including the motion of projectiles in a non-resisting medium and in air; motions of translation, and of rotation of bodies about an axis; falling bodies; central forces; the simple and the compound pendulum; the laws of planetary motion; work, and conservation of energy.

Hydrostatics.—Mechanical properties of fluids; the laws of equilibrium and pressure; the flotation of bodies; the stability and oscillations of floating bodies; specific gravity; the motion of liquids. *Aeriform fluids*: laws of pressure; weight and pressure of the atmosphere; density and temperature; the barometer, the siphon, and the pump.

Acoustics.—Theory of waves; the production and propagation of sound; the numerical evaluation of sound; modes of vibration; communication of vibrations; analysis of vibrations.

Optics.—The propagation, reflection, and refraction of light; lenses, vision, and optical instruments; spectrum analysis; color; the undulatory theory of light; polarization and double refraction.

Electricity and magnetism.—Magnetism; statical electricity; Voltaic electricity; electro-magnetism; electrical measurements; applications of electricity; thermo-electricity.

Chemistry.—Qualitative analysis.

Meteorology and climatology.

Experimental lectures in physics and chemistry.

Heat.—Theories of heat, ancient and modern; sources of heat, conduction, radiation, and convection; specific heat; sensible and insensible caloric; effects of heat; instruments used for the measurement of heat; thermo-dynamics.

Text-books.—Rice and Johnson's Elements of the Differential Calculus, with Lectures; Lectures on the Integral Calculus; Todhunter's Mechanics for Beginners; Wormell's Hydrostatics; Ganot's Physics, (Atkinson's translation); Eliot and Storer's Manual of Chemistry; Eliot and Storer's Chemical Analysis; Deschanel's Natural Philosophy, Part IV.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

LAW.—Constitution of the United States; international law; origin and growth of the science; rights and duties of nations in peace and war; rights of interference, of jurisdiction over the sea, of commerce, of passage over land and navigable rivers; extradition; duties of ministers, consuls, and naval commanders; confiscation of enemy's property and debts; embargoes; kinds of property liable to capture; domicile; privateering; prizes; *jus postliminii;* rights and duties of neutrals; law of contraband; law of blockade; right of search; ship's papers; truces, passports, and treaties of peace; offenses against the law of nations; piracy; slave-trade.

Outlines of Maritime Law.

Lectures.

Text-book.—Kent's Commentaries, vol. 1.

HISTORY.—Origin and ethnological grouping of Aryan, Semitic, and Turanian nations; outlines of history, especially the history of Greece and Rome, of the Holy Roman Empire, and of the states of Western Europe down to 1872; historical geography. Progress of colonial development in America; history of the United States; naval history; lectures.

Text-books.—Freeman's Outlines of History, with Mitchell's Ancient Atlas and Johnston's Historical Atlas. Eliot's History of the United States, with Appleton's and Mitchell's Modern Atlases.

PHYSICAL GEOGRAPHY.—Ansted's Physical Geography, with Weller's Physical Atlas.

RHETORIC AND COMPOSITION.—Essential properties of style. Classification of sentences; rules for the construction of sentences. Figures of Rhetoric. Exercises in the composition of themes and official reports.

Text-book.—Bain's Rhetoric.

ENGLISH GRAMMAR.—Historical development of the English language; relation of English to the other Aryan languages; changes wrought by foreign influence on the grammar, vocabulary, and pronunciation of English; progress from the synthetic to the analytic forms of speech; character and course of inflexional development. Grimm's law. Etymology; inflexional changes since the Conquest. Syntax; analysis of sentences.—Readings from classical authors, with applications of the principles of grammar, and exercises in analysis, and in tracing the etymological meaning of words.

ENGLISH LESSONS.—Classification of words; definition of words by usage, and by derivation; synonyms; force of the common prefixes, affixes, and roots; laws of change in the meaning of words, by contraction, extension, and amelioration.—Relation between spoken and written language; faults in diction, and their remedies. Metaphor, as the basis of language. Selection and arrangement.—Elementary principles of reasoning; the sources of knowledge and of error; induction and deduction; errors in reasoning; fallacies.

Text-books.—Tancock's English Grammar and Reading Book. Seeley and Abbott's English Lessons. Hart's Manual of Punctuation.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH AND SPANISH LANGUAGES.—Grammar; exercises in reading, writing, and conversation.

Text-books.—Fasquelle's French Grammar; Howard's Aid to French Composition; Prud'homme's French Nautical Phrases; Erckmann-Chatrian's Le Conscrit. Roget's Spanish Manual; Tolon's Reader.

DEPARTMENT OF DRAWING.

Right-line drawing; free-hand drawing and perspective; topographical and chart drawing.

The foregoing studies are distributed over four years, and the Cadet-Midshipmen are arranged in four classes, each class pursuing the course for the year.

PROGRAMME OF STUDIES FOR CADET-MIDSHIPMEN.

The time devoted to daily recitations is divided into three periods, designated thus: (1), (2), (3). (1) denotes first period, from 8.30 a. m. to 10.30 a. m., except on Mondays, when it is from 9 a. m. to 11 a. m.; (2) denotes second period, from 10.45 a. m. to 12.45 p. m., except on Mondays, when it is from 11 a. m. to 12.55 p. m.; and (3) denotes third period, from 2 p. m. to 4 p. m. Practical exercises begin on Saturdays at 10.45 a. m., and on all other days, except Sundays, at 4 p. m.

First term: October 1, 1874, *to February* 1, 1875.

Department.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Seamanship	[Th.] (3)	Practical Exercises.
Mathematics	[M. T. W. Th. F.] (2) [S.] (1)	Algebra and Geometry.
English Studies, History, and Law	[M. T. W. Th. F.] (1) [T. F.] (3)	Grammar, History and Composition.
Modern Languages	[M. W.] (3)	Fasquelle's Grammar.
THIRD CLASS—SECOND YEAR.		
Seamanship	[T. F.] (2)	Luce's Seamanship, and Practical Exercises.
Gunnery	[M. W.] (2)	Ordnance Instructions.
Mathematics	[M. T. W. Th. F.] (1)	Trigonometry and Spherical Projections.
	[Th.] (3)	Descriptive Geometry.
English Studies, History, and Law	[M. W.] (3) [S.] (1)	Physical Geography.
Modern Languages	[T. F.] (3) [Th.] (2)	Fasquelle's Grammar, and French Composition.
SECOND CLASS—THIRD YEAR.		
Seamanship	[M. F.] (3) [W.] (1)	Luce's Seamanship [M. and W.]
Gunnery	[F.] (2)	Ship-building [F.] Infantry Tactics.
Physics and Chemistry	[M. T. Th. F. S.] (1) [T. Th.] (2)	Applied Mathematics [M. T. Th. F.] (1). Magnetism and Electricity [T. Th.] (2) [S.] (1).
Modern Languages	[M. W.] (2) [Th.] (3)	French Grammar, Le Conscrit, and Sadler's Petit Cours.
Drawing	[T. W.] (3)	Sketching.
FIRST CLASS—FOURTH YEAR.		
Gunnery	[M. T. W. Th.] (3)	Ordnance and Naval Gunnery and Practical Exercises.
Steam-Enginery	[T. Th.] (2) [S.] (1)	Marine Steam-Engineering and Practical Exercises.
Astronomy, Navigation, and Surveying.	[M. T. Th. F.] (1)	Navigation and Nautical Astronomy. Practical Exercises.
Physics and Chemistry	[M. W. F.] (2)	Optics and Acoustics.
Modern Languages	[W.] (1) [F.] (3)	Spanish: Ollendorff's Method.

Second term: February 1, 1875, to June 1, 1875.

Department.	Periods.	Subjects.
FOURTH CLASS—FIRST YEAR.		
Seamanship	[M.] (3)	Practical Exercises.
Mathematics	[M. T. W. Th. F.] (2) [S.] (1)	Algebra and Geometry.
English Studies, History, and Law	[M. T. W. Th. F.] (1)	English Lessons, History and Composition.
Modern Languages	[T. W. Th. F.] (3)	French Grammar and Exercises.
THIRD CLASS—SECOND YEAR.		
Seamanship	[T. F.] (2)	Luce's Seamanship, and Practical Exercises.
Mathematics	[M. T. W. Th. F.] (1)	Analytical Geometry and Descriptive Geometry.
Drawing	[W. F.] (3)	Topography.
Physics and Chemistry	[M. W.] (2) [S.] (1)	Chemistry.
English Studies, History, and Law	[T. Th.] (3)	Rhetoric and Composition.
Modern Languages	[M.] (3) [Th.] (2)	Fasquelle's Grammar and French Composition.
SECOND CLASS—THIRD YEAR.		
Seamanship	[W.] (1) [F.] (3)	Luce's Seamanship [W.] and Naval Tactics, (Ward and Parker,) [F.]
Ordnance and Gunnery	[M. W.] (3)	Gunnery.
Physics and Chemistry	[M. T. Th. F.] (1)	Applied Mathematics and Mechanics.
Astronomy, Navigation, and Surveying.	[M. W. Th.] (2)	Descriptive and Nautical Astronomy.
Modern Languages	[T. F.] (2) [S.] (1)	Sadler, Nautical Phrase-Book and Grammar.
Drawing	[T. Th.] (3)	Sketching.
FIRST CLASS—FOURTH YEAR.		
Seamanship	[W. Th.] (2) [T.] (3)	Luce's Seamanship, and Nava Construction.
Steam-Enginery	[M.] (2) [W. S.] (1)	King's Marine Steam-Engine, and Practical Exercises.
Astronomy, Navigation, and Surveying.	[M. T. Th. F.] (1)	Nautical Astronomy, and Surveying; Practical Exercises.
Physics and Chemistry	[T. F.] (2)	Heat and Climatology.
English Studies, History, and Law	[W. F.] (3)	Constitution of the United States, and International Law.
Modern Languages	[M. Th.] (3)	Spanish: Ollendorff's Method.

COURSE OF INSTRUCTION FOR CADET-ENGINEERS.

First Class of 1874–'75.

Differential Calculus; Integral Calculus; Mechanics; Hydrostatics; Descriptive Chemistry; Analytical Chemistry; Heat; Electricity and Electrical Measurements; French; Steam-Engineering (practical and theoretical); Mechanical Drawing.

Practical Exercises in Steam-Engineering, Infantry Tactics, and Field-Artillery.

The course of instruction for Cadet-Engineers during the first year will be the same as for the Fourth Class of Cadet-Midshipmen, except the substitution of exercises in Steam-Engineering for those of the Cadet-Midshipmen in Seamanship, Great Guns, and Boat-Howitzers.

Text-books.—Bourne's Hand-Book of the Steam-Engine; Warren's Elements of Mechanical Drawing; Rankine's Steam-Engine and other Prime Movers; Jenkins's Electricity and Magnetism; Eliot and Storer's Qualitative Chemical Analysis. The other text-books used by the Cadet-Engineers are the same as those used by the Cadet-Midshipmen.

PROGRAMME OF STUDIES FOR CADET-ENGINEERS.

The time devoted to daily recitations is divided into three periods, indicated thus: (1), (2), (3). (1) denotes first period, from 8.30 a. m. to 10.30 a. m., except on Mondays, when it is from 9 a. m. to 11 a. m.; (2) denotes second period, from 10.45 a. m. to 12.45 p. m., except on Mondays, when it is from

11 a. m. to 12.55 p. m.; (3) denotes third period, from 2 p. m. to 4 p. m. The daily practical exercises of Cadet-Engineers are the same as those of Cadet-Midshipmen, except the substitution of practical exercises in Steam-Engineering for practical exercises in Seamanship, Great Guns, and Boat-Howitzers.

First term: October 1, 1874, *to February* 1, 1875.

Department.	Periods.	Subjects.
FOURTH CLASS.		
Steam-Enginery	[Th.] (3)	Practical Exercises.
Mathematics	[M. T. W. Th. F.] (2) [S.] (1)	Algebra and Geometry.
English Studies, History, and Law	[M. T. W. Th. F.] (1) [T. F.] (3)	Grammar, History and Composition.
Modern Languages	[M.] (3) [W.] (3)	Fasquelle's Grammar.
SECOND CLASS.		
Mathematics	[M. T. W. Th. F.] (1)	Algebra and Trigonometry.
Modern Languages	[T. F.] (2)	French Grammar.
Steam-Enginery	[T. F.] (3) [W. Th.] (2)	Mechanical Drawing.
	[M.] (2) [Th.] (3)	Steam-Engineering.
	[M. W.] (3) [S.] (1)	Practical Instruction.
FIRST CLASS.		
Physics and Chemistry	[M. T. Th. F.] (1)	Applied Mathematics.
	[M. W.] (2) [Th.] (3)	Heat.
	[W. S.] (1) [Th.] (2)	Chemistry.
Modern Languages	[T. F.] (2)	Fasquelle's French Grammar.
Steam-Enginery	[M. T. W. F.] (3)	Designing and Drawing Machinery, and Practical Instruction.

Second term: February 1, 1875, *to June* 1, 1875.

Department.	Periods.	Subjects.
FOURTH CLASS.		
Steam-Enginery	[M.] (3)	Practical Exercises.
Mathematics	[M. T. W. Th. F.] (2) [S.] (1)	Algebra and Geometry.
English Studies, History, and Law	[M. T. W. Th. F.] (1)	English Lessons, History, and Composition.
Modern Languages	[T. W. Th. F.] (3)	French Grammar and Exercises.
SECOND CLASS.		
Mathematics	[M. T. W. Th. F.] (1)	Analytical Geometry and Descriptive Geometry.
Modern Languages	[M. W.] (2)	Fasquelle's French Grammar.
Steam-Enginery	[M. T. W. Th. F.] (3)	Mechanical Drawing, Steam Engineering, and Practical Instruction.
	[T. Th. F.] (2) [S.] (1)	
FIRST CLASS.		
Physics and Chemistry	[M. T. Th. F.] (1)	Applied Mathematics and Mechanics.
	[W.] (1) [T. Th.] (2)	Magnetism and Electricity.
	[T. Th.] (3)	Chemistry.
Modern Languages	[M. W.] (2)	Fasquelle's French Grammar.
Steam-Enginery	[M. W. F.] (3) [F.] (2) [S.] (1)	Drawing and Designing Machines, Steam-Engineering, (Bourne and Rankine), and Practical Instruction.

FOURTH CLASS.

DEPARTMENT OF MATHEMATICS.

ALGEBRA.

MONTHLY EXAMINATION.

OCTOBER, 1873.—*Time allowed, two and a half hours.*

1. Resolve each of the following expressions into its simplest factors : $a^2c - cd^2$, $a^3 + y^3$, $a^4 + a^2x^2 + x^4$, $x^2 - 7x + 12$, $x^4 - 25x^2 + 144$, and $x^3 - 2x^2 - 5x + 6$. Prove that $a^m - b^m$ is divisible by $a - b$.

2. Divide $x^6 - 2x^5 + 3x^3 + x^2 - 17$ by $x^2 - 2x - 1$. Multiply—

$$\left(x^{a-2b} + y^{2b-a}\right) \text{ by } \left(x^{2b-a} - y^{a-2b}\right)$$

and reduce the result to its simplest form. Find the value of the fraction—

$$\frac{x^2 - 3x + 2}{x^2 - 4x + 3}$$

when $x = 0$, when $x = 1$, when $x = 2$, and when $x = 3$.

3. Reduce the expression—

$$\frac{\dfrac{x}{xy} + \dfrac{y}{x+y}}{\dfrac{x}{x-y} - \dfrac{y}{x+y}}$$

to its simplest form. Find the value of—

$$\left\{\frac{x+2a}{2b-x} + \frac{x-2a}{2b+x} + \frac{4ab}{x^2-4b^2}\right\}$$

$$\text{when} \qquad x = \frac{ab}{a+b}$$

4. Find the value of x in the equation—

$$\frac{x-a}{a-b} - \frac{x+a}{a+b} = \frac{2ax}{a^2-b^2}$$

Find x and y from the equations—

$$ax + by = c,$$
$$bx + ay = d.$$

5. There are two places, a miles distant from each other, from which two persons, A and B, set out to meet on the road. A travels b miles in c hours, and B travels d miles in e hours. How long and how far must each travel before they meet?

MONTHLY EXAMINATION.

NOVEMBER 29, 1873.—*Time allowed, two and a half hours.*

1. Find the 9th term of $(x + y)^{17}$. Write the square of $(a + b + c - d)$. Develop—

$$\frac{1}{(a^3 - x^2)^{-\frac{1}{3}}}$$

to four terms by the binomial formula. Develop—

$$\left[1 + \frac{1}{x}\right]^x$$

to five terms; find the value of this expression when x is infinite.

2. Extract the square root of 1711.059 to two decimal places. Extract the square root of 0.0003715 to four decimal places. Extract the cube root of 37.001285 to four decimal places. A whole number consists of $5n-1$ figures; how many figures are there in its nth root, supposing the number to be a perfect nth power? Supposing the first figure of the root in this case to be 1, what will be the trial-divisor for obtaining the second figure?

3. Find the numerical value of each of the following expressions—

$$(16)^{\frac{1}{2}}, \quad \sqrt{16}, \quad (64)^{-\frac{1}{6}}, \quad \frac{1}{\sqrt[3]{(32)^{-\frac{3}{5}}}}, \text{ and } \left\{(16)^{\frac{1}{4}}\right\}^{-3}.$$

Divide—

$$2x^{\frac{17}{4}}y^{-\frac{5}{2}} - 5x^{\frac{13}{4}}y^{-\frac{3}{2}} + 7x^{\frac{9}{4}}y^{-\frac{1}{2}} - 5x^{\frac{5}{4}}y^{\frac{1}{2}} + 2x^{\frac{1}{4}}y^{\frac{3}{2}} \text{ by } x^{\frac{9}{4}}y^{-\frac{5}{2}} - x^{\frac{5}{4}}y^{-\frac{3}{2}} + x^{\frac{1}{4}}y^{-\frac{1}{2}}.$$

Extract the square root of— $\left[x+\frac{1}{x}\right]^2 - 4\left[x-\frac{1}{x}\right]$

How may the fraction— $\frac{1}{\sqrt{a}+\sqrt{b}}$

be reduced to an equivalent form in which the denominator is rational?

4. Find the numerical value to six decimal places of the expression—

$$\frac{3-\sqrt{5}}{3+\sqrt{5}}, \text{ given } \sqrt{5}=2.236068$$

Reduce the expression—

$$\frac{(2+\sqrt{3})\ (5+\sqrt{5})\ (3+\sqrt{3})}{(2-\sqrt{3})\ (\sqrt{5}+1)\ (\sqrt{3}+1)}$$

to its simplest form.

5. Solve the equations—

$$a\sqrt{b-x} = b\sqrt{a-x},$$

$$\frac{\sqrt{x+a}+\sqrt{x}}{\sqrt{x+a}-\sqrt{x}} = c,$$

$$ax^2+cx = d.$$

SEMI-ANNUAL EXAMINATION.

JANUARY, 1874.—*Time allowed, five hours.*

1. Separate each of the following expressions into its simplest real factors:

$$a^4x^4 - b^4y^4,\ x^3+y^3,\ x^3-y^3,\ x^2-19x+88,\ 4x^2-34x+72,\ 3a^2+4\ ab-4b^2,$$
$$\left\{4(ad-bc)^2-(a^2-b^2-c^2+d^2)^2\right\},\ x^6+1,\ x^4+2x^2+9.$$

2. Show that $a^0=1$, and explain the meaning of a^{-m}. What is the greatest common divisor of two or more quantities? The least common multiple? Find the greatest common divisor of $x^4+24x+55$ and $11x^4+24x^3+125$.

3. Add $\frac{3x-a}{5x+3a}$ to $\frac{x+3a}{7x+9a}$

Take $\frac{a-x}{2a^2+3ax+x^2}$ from $\frac{2a+x}{a^2-x^2}$

Find the value of the fraction—

$$\frac{x^2+3x-28}{x^2+2x-24}$$

when $x=4$. What limiting value does this fraction approach as x becomes indefinitely great?

4. Solve the equation—

$$\frac{x-a}{b}+\frac{x-b}{c}+\frac{x-c}{a}=\frac{x-(a+b+c)}{abc}$$

Find x from the equations $ax+by=c$, $bx=d+ay$, and $x+y+z=a$.

5. Extract the square root of 0.00036 to 5 decimal places. Extract the cube root of 3715.00198 to 3 decimal places. Find y from the equation

$$y^3=8a^6-36a^5c+102a^4c^2-171a^3c^3+204a^2c^4-144ac^5+64c^6.$$

6. What is meant by the degree of an equation? When is an equation said to be homogeneous? What is an indeterminate equation? What is an identical equation? What is a root of an equation? Prove that an equation of the second degree has two roots, and only two, and show to what quantities the sum and the product of these two roots are equal.

7. Write five terms of the development of $(a\pm b)^m$. Write the development of $(a-2c)^5$. Develop $(a-2c)^{\frac{1}{2}}$ to four terms. Develop—

$$\frac{x}{\sqrt[3]{a^3-x^3}}$$

to four terms.

8. Multiply together (x^2+1), $(x^2+x\sqrt{3}+1)$, and $(x^2-x\sqrt{3}+1)$. Find the numerical value of—

$$\frac{\sqrt{3}+\sqrt{2}}{\sqrt{3}-\sqrt{2}}$$

to 3 decimal places. Simplify the expression—

$$\frac{3+4\sqrt{3}}{\sqrt{6}+\sqrt{2}+\sqrt{5}}$$

9. Solve the equations—

$$\frac{x+2}{x-1}-\frac{4-x}{2x}=\frac{7}{3}$$

$$x^4-14x^2+40=0$$

$$(7-4\sqrt{3})x^2+(2-\sqrt{3})x=2$$

10. Find x and y from the equations, $x^2+y^2=\frac{5}{2}xy$ and $x-y=\frac{1}{4}xy$.

Two travelers, A and B, set out at the same time from two places, P and Q, respec-tively, and travel so as to meet. When they meet it is found that A has traveled a miles more than B, and that A will reach Q in b hours and B will reach P in c hours after they meet. Find the distance between P and Q.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, five hours; answers to ten questions required.*

1. Simplify—

$$\frac{1}{(a-b)(a-c)}+\frac{1}{(b-a)(b-c)}+\frac{1}{(c-a)(c-b)}$$

and

$$\frac{x^{p+q}}{x^q}\div\frac{q}{x^{q-p}}$$

Find the value of the expression $\dfrac{x^2+xy+y^2}{x^2-xy+y^2}$

when $x=\dfrac{2+\sqrt{3}}{2-\sqrt{3}}$, and $y=\dfrac{2-\sqrt{3}}{+\sqrt{3}}$

2. Solve the equations—

$$(x+a)(x+a+b) = (x+b)(x+3a)$$

and—

$$\begin{cases} x^2+mx = ny^2 \\ \frac{x}{a}+\frac{y}{b} = 1 \end{cases}$$

3 Solve the equations—

$$\sqrt{2x-1}+\sqrt{3x+10} = \sqrt{11x+9}$$

and—

$$\begin{cases} x+y = a\sqrt{xy} \\ x-y = c\sqrt{\frac{x}{y}} \end{cases}$$

4. Form the equation whose roots are $1 \pm \sqrt{-2}$, and $2 \pm \sqrt{-3}$, and find the equation whose roots are greater by unity than those of the resulting equation. Solve the equation—

$$x^3 - 18x^2 + 157x - 510 = 0$$

by first removing the second term. Transform the equation—

$$x^3 + 5x^2 + 8x - 1 = 0$$

to another wanting the third term. Divide—

$$x^6 + 11x^4 + 13x^2 + 15x + 17 \text{ by } x^3 - x^2 - x - 1$$

by synthetic division.

5. Prove that the sum of any $(2n+1)$ consecutive integers is divisible by $(2n+1)$. In an arithmetical progression, given d, l, and s, find a. In a geometrical progression, given a, l, and s, find r.

6. Two trains, a feet and b feet in length, respectively, move on parallel rails, with uniform velocities. When they move in opposite directions, they are observed to pass each other in c seconds; but when they move in the same direction, the faster train is observed to pass the other in d seconds. Find the rate at which each train moves.

7. Separate each of the following fractions into partial fractions—

$$\frac{x^2+3}{x(x-1)(x-2)(x-3)}, \quad \frac{x^2+3}{(x+1)(x-1)^3}, \text{ and } \frac{x^2+3}{x^6-1}$$

Write the development that should be assumed in order to separate—

$$\frac{1}{x(x-1)^2(x^2+1)(x^2-x+1)^2}$$

into partial fractions.

8. Find K from the formulas—

$$K = \sqrt{s(s-a)(s-b)(s-c)(s-d)}$$
$$s = \tfrac{1}{2}(a+b+c+d)$$

Given—

$a = 6.3246$, $c = 8.5441$,
$b = 7.7459$, $d = 5.1961$.

9. Find the modulus of the system of logarithms whose base is 7. Find x from the equation—

$$\left[\frac{a}{c}\right]^{\frac{a}{x}} = d^x$$

Given—

$a = 0.0057643$, $c = 1.0433$,
$b = 4.5763$, $d = 10.024$.

10. Solve the equation—

$$x^3 - 1536.09 = 0$$

by Horner's method, obtaining the root to three places of decimals. Solve the following equations, which have a root in common—

$$x^3 - 3x^2 - 16x - 12 = 0,$$
$$x^3 - 7x^2 + 5x + 13 = 0.$$

11. Deduce Cardan's rule for the solution of cubic equations, and apply it to solve the equation—

$$x^3 - 9x^2 + 28x - 34 = 0.$$

GEOMETRY.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, five hours; answers to ten questions required.*

1. What is meant by a *medial line?* What is the difference between a trapezium and a trapezoid? What is a spherical triangle? A polar triangle? A tri-rectangular triangle? Define *cylindrical surface.* What is the significance and numerical value of π? The area of a circle being denoted by c^2, find its radius and circumference.

2. Prove that the three perpendiculars erected at the middle points of the sides of a triangle meet in a point. Prove that the chord of an arc of 60° is equal to the radius.

3. Prove that the area of a regular dodecagon is equal to three times the square described on the radius of the circumscribed circle. Denoting this radius by a, find an expression for the length of the perimeter of the dodecagon.

4. Prove that the sum of all the face-angles of any convex polyhedral angle is less than four right angles. State and prove the theorem from which is derived the formula for the volume of a triangular pyramid.

5. Find the area in square miles of a polygon formed by arcs of great circles on the surface of the earth, the angles of the polygon being 137° 30′, 213° 14′ 30″, 29° 45′ 30″, 111° 30′, 50° 30′, and the radius of the earth 4,000 miles.

6. A rectangle $ABCD$ has its side BC double the side CD. A diagonal is drawn and a circle described on AD as a diameter. The whole figure is then revolved about AD as an axis. It is required to determine (1) the relation between the volumes of the three solids so generated—cone, cylinder, and sphere; and (2) the relation between the surfaces of these solids.

7. What must be the diameter of the bore of a gun to throw a shot similar to that thrown by a XV-inch gun and of double its weight? Find the weight of the XV-inch spherical shot, supposing a cubic foot of iron to weigh 450 pounds.

8. A cylindrical beam is 30 feet in length and 2 feet in diameter. Find the volume, in cubic feet, of the greatest rectangular beam that can be cut from it, having its adjacent sides in the ratio of 2 : 3.

9. A rectangular parallelopiped and an oblique prism stand upon a horizontal plane. The base of the prism is an equilateral triangle, and its edges are parallel to one of the diagonals of the parallelopiped. It is required to find the volume of the prism and the area of its right section, having given the sides of the base of the parallelopiped a and b, and its altitude h, the side of the prism c, and edge d.

10. An element of a right circular cone makes an angle of 60° with the plane of its base. What must be the altitude of the cone in order that its volume may be equal to that of a sphere 10 inches in diameter? Compare the surfaces of the cone and sphere.

11. An isosceles triangle, having its base equal to $2a$ and its altitude to a, has inscribed within it a rectangle, one of whose sides is a. In the portion of the triangle between the vertex and the rectangle a similar rectangle is inscribed, and so on *ad infinitum.* Find the sum of the areas of all the rectangles.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

OUTLINES OF HISTORY.

SEMI-ANNUAL EXAMINATION.

JANUARY 29, 1874.—*Time allowed, five hours.*

A number marked with an asterisk (*) may be substituted for the same number without it, but for no other.

1. Place, geographically and ethnologically,—1. Basque. 2. Breton. 3. Magyar. 4.

Angles [before 450 A. D.]. 5. Czech. 6. Bulgarian [950 A. D.]. 7. Carthaginian. 8. Danes in England [before 1013].

2. (*a*) Athens, (1) after the Persian wars, (2) after the Peloponnesian war.

(*b*) "The geographical nature of the land settled the history of the Greek people." Explain.

(*c*) 133 B. C. Three events.

(*d*) Show the connection between Augustus, Charles the Great, and Francis II., King of Germany. All Roman emperors: how?

2.* (*a*) Achaian League.

(*b*) Explain the terms *Tyrant* [ancient Greece], *Emperor*, *Caliph*, *Exarch*, *Patrician* [early commonwealth], *Patrician* [Pippin]. (Take last two and any two of the first four.)

(*c*) How did Augustus get absolute power?

(*d*) "Christianity took different shapes in different parts of the Roman empire." Apply this to the three geographical divisions under Constantine.

3. (*a*) Frankish empire of Charles the Great; French empire of Bonaparte [1812]. Compare: as to (1) nationality, (2) imperial rights, (3) geographical limits.

(*b*) 710, 732, 1453, 1492, 1571. Connect.

3.* (*a*) Lotharingia; boundary of kingdom [843]; modern name, (1) French, (2) German. Extent of modern province.

(*b*) Laon and Paris [887–987]. Compare (*full answer*).

4. (*a*) What was the mediæval theory of the Church and the Empire? What prevented this theory from being carried out?

(*b*) How did the feudal system affect forms of government?

(*c*) Show the workings of the system in France.

(*d*) State the claims of Anjou and Aragon to the throne of Naples.

5. (*a*) Name the first four Angevin kings of England, and tell how the family came to the throne.

(*b*) Peace of Bretigny; treaty of Troyes. Dates and provisions of each.

(*c*) What did England keep at the end of the 100-years' War?

5.* (*a*) 1215, 1265: connect. Explain in full the constitutional change accomplished at the second date. By whom was it brought about?

(*b*) How far did ecclesiastical reform go under Henry VIII.?

(*c*) Show the claims of George I. to the throne of England. (Make a table.)

6. (*a*) Name the three cantons which began the Swiss league. What were the relations of the league with the dukes of Austria? How were these relations settled at Morgarten and Sempach?

(*b*) Name the Emperors from Rudolf I. to Frederick III., showing to what line each one belongs.

6.* (*a*) State the political and geographical changes in the Netherlands since 1609.

(*b*) War of the Spanish Succession; war of the Polish Election; war of the Austrian Succession. Points at issue and results in each case.

7. In the period 1713–1789, "a new German power came to the front in Germany, and it has gradually grown to be the head of Germany, much in the same way as Wessex grew in England, Castile in Spain, and France in Gaul. But its rise did not, like the rise of Russia, bring a race and religion from the background to the front." Explain in full all the allusions.

8. (*a*) How did Bonaparte provide thrones for the different members of his family? (*b*) Four revolutions: 1789, 1830, 1848, 1851. State the causes and character of each. (*c*) Give dates and results of each of the three wars in which France has been engaged since the last of these revolutions.

9. (1) Salamis, (2) Constance, (3) Leipsic, (4) Plassey, (5) Clermont, (6) Novara, (7) Tilsit, (8) Belgrade, (9) Gothland, (10) Metz. Give geographical position, and point of historical importance. (Take six.)

ENGLISH GRAMMAR.

SEMI-ANNUAL EXAMINATION.

JANUARY 26, 1874.—*Time allowed, five hours.*

I.

1. Give the subdivisions of the family of languages to which English belongs, and state the languages comprised in each group.
2. What are the tests of kinship in related languages?
3. Explain the terms British, Saxon, English, as applied in the VI. century. Comment on the term Anglo-Saxon.
4. Show why inflexions are lost in the development of a language.

II.

1. "Close likeness to Scandinavian dialects is to be found in Northern English; close likeness to Frisian dialects in Southern English." Why?
2. In what four ways did Latin exert an influence over the English language?
3. How and when did the Provençal influence English?
4. What were the four dialects of the *langue d'Oil?*

III.

1. "The Northmen, who became Frenchmen in France, became Englishmen in England." Explain and illustrate.
2. Why is English rich in synonyms? Give examples.
3. What was the character of the words introduced by the Norman-French? How did they come to be introduced?

IV.

1. Define *auxiliary verb, syntax, adjective, root, inflexion, absolute superlative.*
2. Inflect the noun *eage* [eye], giving forms of the XI. century, of the XIV. century, and of modern English.
3. Give the distinguishing marks of the four declensions. Which of them is most common? Why?

V.

1. Explain the formation and etymological force of *nearer, lady, gentle.*
2. Illustrate the gradual loss of inflexions in English by the case of the adjective *góda* [good]. (O. E. inflexions in full.)
3. Discuss the theory that the possessive case of nouns is formed by the elision of the possessive pronoun *his.*
4. Compare *old, tidy, shy.*

VI.

1. Give all the inflected tense-forms of the verb *to love* [*lufian*], in the indicative mood, in the three stages of English inflexion.
2. Give the three successive forms of the past participle of the same verb.
3. Explain the formation of any four of the following: *Outlaw, grapple, hillock, gladsome, mankind, sweeten, liquefy, rookery.*
4. Give the history of the terminations in the following: *Dorchester, songstress, riches, only, known, lent.*

VII.

"*Though* justice be thy plea, consider this,
That in the *course* of justice, *none* of us
Should see salvation; we do pray for mercy,
And that same prayer doth teach us all to *render*
The *deeds* of mercy. I have spoke thus much
To *mitigate* the *justice* of thy plea;
Which, if thou *follow,* this *strict court* of Venice
Must needs give *sentence 'gainst* the *merchant* here."

Explain etymologically and syntactically the words in italics.

VIII.

"Strike, as thou didst at Cæsar; for I know
When thou didst hate him worst, thou lovedst him better,
Than ever thou lovedst Cassius."

Analyze.

IX.

"Now of my own accord such other trial
I mean to show *you* of my strength: yet *greater*,
As with *amaze shall strike* all who behold."

Explain the construction of the words in italics.

X.

Give the principal parts of all the verbs in the above extracts, designating the conjugation (weak or strong) to which each belongs, and explaining peculiarities of formation.

ENGLISH LESSONS.

ANNUAL EXAMINATION.

MAY 23, 1874.—*Time allowed, five hours.*

I.

1. How is the meaning of a word ascertained by induction?
2. How is it ascertained by deduction?
3. Show, with instances, the danger of trusting entirely for the meaning of a word to a knowledge of its roots.
4. What are synonyms?
5. Take as illustrations any three synonymous words, and show by the method of elimination the difference in meaning.

II.

1. "To increase one's vocabulary does not always imply increasing the number of one's notions." Show this.
2. Explain generalizing.
3. What are *hybrids*, and what rule for the formation of words do they violate?
4. State Grimm's law, and account for its existence.
5. Name the six laws of linguistic change, and give an illustration of each, showing from the etymology of the word how the law applies.

III.

1. Show that impassioned prose may approximate to the (*a*) metre, (*b*) brevity, of poetry. In what point does the best prose of this kind keep itself distinct from poetry?
2. When are poetic quotations and periphrases admissible, and when not?
3. What is the fault of *fine writing*, and how is it to be avoided?
4. Distinguish between a long enumerative sentence and a long complicated sentence.
5. What is a heterogeneous sentence? Wherein consists the difficulty of understanding it?

IV.

1. What is an antithetical style? What are its advantages?
2. Explain the three forms of personification.
3. Show that implied metaphor is the basis of a great part of language.
4. Explain hyperbole.
5. Give the laws regulating the formation and employment of metaphors.

V.

1. What is the aim of scientific composition?
2. How is uniformity of arrangement carried out in the different kinds of scientific writing?
3. What considerations are excluded from didactic composition, and why are they excluded?

4. What are the characteristics of imaginative literature?

5. Name and classify the different kinds of incidents which are said to be interesting, in themselves or indirectly.

VI.

1. Explain the sources of knowledge, and the corresponding sources of error.

2. What is meant by induction through enumeration?

3. Why is experiment necessary to induction?

4. Show how experiment can prevent the error *post hoc, ergo propter hoc.*

5. Explain the character and force of the argument from analogy, in predicting the recurrence of natural phenomena.

VII.

1. Explain the terms *proposition, middle term, syllogism, distribution, ignoratio elenchi, begging the question.*

2. What are *universal propositions? Propositions of identity?*

3. Explain the process of *definition* as compared with *description.* What are provisional definitions?

4. Explain the difference between *essentials* and *accidents.*

5. What is meant by *mathematical certainty?*

VIII.

1. Speaking of Rome in the time of the empire, Merivale says, "The shadowy phantom of the Republic continued to flit before the eyes of Cæsar. There was still, he apprehended, a germ of sentiment existing, on which a scion of his own house, or even a stranger, might boldly throw himself, and raise the standard of Patrician independence." Criticise this.

2. "The wine of life is drawn; and the mere lees
Is left this vault to *brag* of."
Expand; point out the fault in *brag.*

3. "They would free us from the yoke of error." Expand.

4. A raging storm. A cruel disaster. A dying lamp. The force of sympathy. I see the point. A rigid system of trade. It is high time.
Show how analogy has given rise to these expressions.

IX.

1. "Hunger, gaunt and famine-eyed." Explain the figure.

2. "Where we are,
There's daggers in men's smiles; the near in blood,
The nearer bloody." Explain.

3. "Some schooners have three masts; ocean-steamers are not schooners." Conclusion? Draw diagram and explain.

4. "All cyclones are dangerous to ships; some storms are cyclones." Conclusion? Draw diagram and explain.

X.

1. "Everything which obstructs the free course of justice deserves the reprobation of the virtuous. There are modes of enforcing the letter of the law which obstruct the strict course of justice." Conclusion? Draw diagram.

2. Convert the following propositions: "All horses are animals." "All men are endowed with reason." "No honest men are unjust." "No frigate is an iron-clad." "General Grant is President of the United States." State the character of each proposition.

3. A member of Parliament advocated the passage of a certain bill under discussion. He was followed by a member of the opposition, who proved conclusively that the last measures brought forward by the government had been attended with disastrous re-

sults. In consequence of his speech, several members changed their minds, and voted against the bill. Discuss the cause of their change.

4. A and B arguing at an election:

A. You ought to be ready to follow Gladstone's leadership.

B. Why?

A. Because his ideas of reform are the correct ones.

B. But how do I know that they are correct?

A. You surely cannot doubt their correctness, when they have such a high authority as Gladstone.

Criticise the reasoning.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

ANNUAL EXAMINATION.

MAY, 1874.—SPECIMEN-QUESTIONS.

Translate into French:

Who has silk velvet?
The hatter has silk velvet and a silk hat.
Has your brother that lady's umbrella?
Are you more attentive than your sister's husband?
I am not so attentive to ladies as he is.
Has your gardener many good vegetables this year?
Yes, sir, he has; but not so many as last year.
What day of the month is to-day?
I believe it is the sixth.
How old is your brother-in-law?
He is fifty years old.
Does your companion like reading?
My companion does not like reading.
What is the Irishman going to do?
He is going to teach music.
Will you send my letter to him to-morrow?
I will send it to you to read first.
Does your family-physician understand French?
He knows French, English, and German very well.
Have you what you want?
We have not always what we want or wish.
Whose hat is that in your room?

Conjugate all moods and tenses of the verbs avoir *and* être.

ORAL EXAMINATION.

Name the different accents employed in French.

Give the French alphabet.

Are final consonants pronounced in French?

What do you understand by *h*, mute or aspirate?

How many articles are there in French?

What occurs when the article precedes a word beginning with a vowel? With *h* mute?

How many genders are there?

Is there any rule for distinguishing gender?
Give the rules governing the contraction of the article.
Which is put first in French, the possessor or the object possessed?
Explain what is meant by "a partitive sense."
How are sentences made negative?
Give all the idioms formed with *avoir*.
If a noun is taken in a partitive or a general sense, what commonly precedes it?
Name the demonstrative pronouns, and tell what positions they occupy.
Supposing that any difference exists between *this* and *that*, how is the difference expressed in French?
How is the plural of nouns formed?
Do adjectives follow the same rule?
How many conjugations are there? Give the terminations of each.
Explain the use of *en*.
Give the cardinal numbers from 10 to 65.
Which is correct, *le onze*, or *l'onze*?
Conjugate the verbs *faire*, *aller*, and *dire*.
Conversation in simple phrases.

THIRD CLASS.

DEPARTMENT OF SEAMANSHIP.

PRACTICAL SEAMANSHIP.

ORAL EXAMINATION, SPECIMEN-QUESTIONS, MAY, 1874.

I.

1. Describe hawser-laid rope.
2. Make a log line. State how the length of a knot is ascertained.
3. Fit No. 1 pair of lower shrouds.
4. Reeve and set up flying-jib and royal stays.
5. Reeve a crossjack brace.
6. Sheet-anchor in scow alongside; stow it.
7. Ship heads ENE. $\frac{1}{2}$ E. on port tack; how will she head on starboard tack?

II.

1. Describe the manner of straight-pointing a rope.
2. Describe a gun-tackle purchase; state its use and the power gained.
3. State in what order the rigging goes over the fore-topmast-head.
4. Rig purchase, and get over whole tops.
5. Reeve main bowline.
6. Stow a jib.
7. Ship heads NW. by W. $\frac{1}{4}$ W. on starboard tack; how will she head on port tack?

III.

1. Describe shroud-laid rope. State its use.
2. Describe a log-line and time-glasses.
3. Fit mast-head pendants.
4. Send aloft and cross a topsail-yard.
5. Reeve a fore-topsail brace.
6. Transport a sheet-anchor from waist to bow.
7. Ship heads N. $\frac{3}{4}$ E. on the port tack; how will she head on the starboard tack?

IV.

1. How is wire rope made?
2. Describe a ground-log. State its use.
3. Measure for each pair of lower shrouds, in their order.
4. Send aloft and rig a topmast-studding-sail-boom.
5. Reeve a fore-brace.
6. Describe yard-tackles, triatic-stay, mast-head pendant, tackles, and a winding-purchase. State how they are applied.
7. Ship heads NE. by E. $\frac{1}{2}$ E. on port tack; how will she head on the starboard-tack?

V.

1. How are Spanish-foxes made? State their use.
2. Fit a single Spanish-burton. State the power gained.
3. Measure for and fit mizzen-royal stay.
4. Rig whips, send aloft and place lower stays, and reeve laniards.
5. Reeve spanker-sheets.
6. Name and describe the different parts of an anchor.
7. Ship is running 4 points free, on port tack, wind NNE.; how does she head?

VI.

1. How is a stopper clapped on a fall?
2. What is houseline? Marline? Spun yarn?
3. Describe a bowsprit and its rigging, (iron work.)
4. Hoist in lower masts, all preparations having been made.
5. Reeve main-topgallant bowline.
6. Make preparations for bending a topsail.
7. Ship heads SSW. $\frac{1}{4}$ W., wind on starboard quarter, (4 points;) how will she head when brought by the wind on the other tack?

VII.

1. Make a short splice.
2. How are soundings called? Call 4, 7, 10, 8, 3, and 13 fathoms, respectively.
3. Measure for and fit mizzen-topmast stay.
4. Point, rig, and rig out a flying-jib-boom.
5. Reeve a fore-royal brace.
6. Get the anchors off the bow.
7. Ship heads ESE. $\frac{1}{2}$ E.; a sail is reported on the starboard beam; how does it bear?

VIII.

1. Make a studding-sail-halyard bend.
2. In hoisting a weight with a tackle, which part of the fall bears the most strain? Why?
3. Measure for and fit jib-stay.
4. Reeve topgallant mast-rope and fid topgallant-masts.
5. Reeve a topsail lift.
6. Name and describe the different stoppers used in connection with a chain-cable, and state how they are applied.
7. Ship heads ESE. $\frac{3}{4}$ E. on port tack; how is the wind?

IX.

1. Bend two hawsers together.
2. What is meant by a "thoroughfoot" in a tackle?
3. Measure for and fit mizzen-topmast backstays.
4. Jib-boom pointed; rig it, reeve heel-rope, and rig out.
5. Reeve a lower lift.
6. Describe the manner of surging a cable.
7. Ship heads ESE. $\frac{3}{4}$ E. on starboard tack; how is the wind?

X.

1. Make a long splice.
2. How is a hand lead-line marked and fitted?
3. Measure for, and fit fore-topmast backstays.
4. Place royal rigging on funnel on deck, send it aloft, and place it.
5. Reeve a main royal brace.
6. Secure an anchor for sea.
7. Ship heads N. by E. $\frac{1}{2}$ E. on port-tack; how will she head on starboard-tack?

DEPARTMENT OF ORDNANCE AND GUNNERY.

ORDNANCE INSTRUCTIONS.

SEMI-ANNUAL EXAMINATION.

JANUARY 26, 1874.—*Time allowed, four hours.*

1. Station a gun's crew of sixteen men and a powderman at a broadside gun, and state what stations are omitted in reducing to fourteen, twelve, and ten men, respectively.
2. Cast loose and provide a broadside gun of sixteen men and a powderman.
3. Sponge, load, and shift breeching.
4. Shift right truck.
5. Station twenty-four men and a powderman at an 11-inch pivot-gun.
6. Give rules for division of men at guns, for boarders, riflemen, pumpmen, firemen, and sail-trimmers.
7. Shift pivot.
8. What are the charges for an 8-inch gun? What for a 9-inch gun?
9. How is a broadside gun thrown overboard?
10. What precautions are observed when the crew is suddenly called away from a gun which is cast loose?
11. Name the inspecting instruments for examining guns and explain their uses.
12. House a lower-deck gun.

DEPARTMENT OF MATHEMATICS.

STEREOGRAPHIC PROJECTIONS.

MONTHLY EXAMINATION.

NOVEMBER, 1873.—*Time allowed, two and a half hours.*

1. What is a line of measures? Prove that in stereographic projections of the sphere the distance of the projection of any point from the centre of the primitive circle is $a \tan \frac{1}{2} p$, where a denotes the radius of the sphere, and p the polar distance of the point. Deduce the corresponding expression for orthographic projections. Explain the term *subcontrary section*, and prove that the subcontrary section of an oblique cone with a circular base is a circle.
2. In what case does the projection of a circle become a straight line? What important property has this straight line? Prove that in stereographic projections of the sphere the angle between any two arcs is equal to the angle between their projections. The projection of one pole being given, show how to project the other pole, and give the reasons for the construction.
3. Project a small circle whose polar distance is 30°, (1) when the inclination of the circle is 0°; (2) when it is 30°; (3) when it is 90°; (4) when it is 105°.
4. Project a spherical triangle and its polar triangle, having given: a, 45°; b, 60°; C, 45°. (Take the angle C at the center of the primitive circle).
5. Project the astronomical triangle, given $L = 30°$ N., $d = 30°$N., $h = 45°$, (1) on the plane of the horizon; (2) on the plane of the prime vertical; (3) on the plane of the meridian: in each case the point M to be west of the meridian.

SPHERICAL TRIGONOMETRY.

MONTHLY EXAMINATION.

JANUARY 2, 1874.—*Time allowed, two and a half hours.*

1. Apply the formula $\sin^2 \frac{1}{2} A =$. . . . . to the astronomical triangle to find t, L, h, and p being given.

Given L, 43° 20′ 15″ N.
d, 6° 11′ 30″ S. } Find t.
h, 22° 29′ 30″

2. Given A, 140° 38′ 45″
B, 42° 33′ 30″ } Find a and C.
c, 129° 21′ 15″

3. Given A, 47° 26′ 30″
B, 127° 30′ 45″ } Find C and b.
a, 30° 13′ 45″

4. Given t, 2^h 37^m 25^s
d, 18° 20′ 30″ N. } Find h.
L, 40° 35′ 45″ N.

5. Given t, 1^h 59^m 58^s
d, 15° 00′ 45″ S. } Find L.
h, 60° 00′ 30″

Make a stereographic projection of this triangle on the plane of the equator, using only given parts in the construction.

PLANE TRIGONOMETRY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1874.—*Time allowed, five hours.*

1. What is the sine of an angle? The versed sine? The tangent? What are the limiting values of each of these functions? Show how the log sin or log tan of a small angle may be found. Apply this method to find log cot 11′ 30″. Prove the following formulas:

$$\sin^2 x + \cos^2 x = 1$$
$$1 + \tan^2 x = \sec^2 x$$

What rule is to be followed in taking from the tables the logarithms of the trigonometric ratios of the angle $\left[\frac{n\pi}{2} + y,\right]$ n being any whole number? What is meant by the *natural* sine of an angle?

2. What is a logarithm? A common logarithm? A Naperian logarithm? How can the Naperian logarithm of any number be found from a table of common logarithms? What quantities have negative logarithms? What quantities have no logarithms? Find the number whose logarithm is $-(0.37568)$. How is such a logarithm usually written.

When is a quantity said to be a function of another quantity? When an explicit function, and when an implicit function?

3. Find x from the formula—

$$x = \frac{\sin a \cos b \tan c \tan d \sec e}{\tan f \cos g \sin h}$$

having given—

a, −31° 30′
b, 217° 20′
c, 131° 15′
d, 416° 29′
e, 89° 45′ 30″
f, 337° 45′
g, 90° 3′
h, 783° 5′

4. Deduce expressions for the sine, cosine, and tangent of $(x \pm y)$.

5. What is meant by the expression $u = \sin^{-1}x$? Given $x = 2$, find the value of u in terms of π in each of the following equations:

$$u = \sin^{-1}\frac{x}{4}$$

$$u = \tan^{-1}\frac{x}{2}$$

$$u = \text{ver}\sin^{-1}x$$

Given $u = \tan^{-1}x$, find an expression for $\sin 2u$ in terms of x.

Find the numerical values of the sine, cosine, and tangent of $\frac{\pi}{6}$ without using the tables and simply indicating the square roots.

6. Find u from the equation—

$$u = \tan^{-1}\tfrac{1}{3} + \tan^{-1}\tfrac{1}{5} + \tan^{-1}\tfrac{3}{11}.$$

Given $\text{cosec}\,2x - \sin 2x = \tan x$, find an expression for $\sin x$.

7. What precept is to be employed in the solution of plane right triangles?

Prove that in any plane triangle—

$$\frac{a+b}{a-b} = \frac{\tan\frac{1}{2}(A+B)}{\tan\frac{1}{2}(A-B)}$$

and that—

$$a^2 = b^2 + c^2 - 2bc\cos A$$

8. Deduce an expression for $\sin^2\frac{1}{2}A$ in an oblique triangle. Write expressions for $\cos^2\frac{1}{2}A$, $\tan^2\frac{1}{2}A$, and K.

9. Given—

ε, 2.7183
y, 4.5672
x, 3.0041
π, 3.1416

find u from the equation—

$$u = \varepsilon^{\tan^{-1}\frac{y}{x}}$$

10*. A ship was sailing SW, at the rate of 10 miles an hour. At 9 a. m. a light-house bore SSW. and at 11 a. m. the same object bore E. by N. How near to the light-house did the ship pass?

10*. Two hills, AB and AC, rise from the same point. The inclination of AC to the horizon is α, and that of AB is β. At a point a feet from A on AC, the angles of elevation of the bottom and top of a vertical object on the top of the other hill are α_1 and β_1 respectively. Deduce a formula by which x, the height of the object, may be found when α, α_1, β, β_1 and a are given. Also, find x, having given the values—

α, 30° 15′
α_1, 37° 30′
β, 55° 30′
β_1, 38° 45′
a, 128 feet

SPHERICAL TRIGONOMETRY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1874.—*Time allowed, five hours.*

1. Enunciate and prove the two fundamental theorems of spherical trigonometry. Apply the formula obtained in each case to the polar triangle.

2. Deduce directly from the fundamental theorems all the formulas used in the solution of spherical right triangles. Show how all these formulas may be comprehended under two simple rules.

3. Deduce an expression for $\cos^2\frac{1}{2}A$ in an oblique spherical triangle, and apply the result to the polar triangle.

4. Assuming the formula—

$$\tan^2\tfrac{1}{2}A = \frac{\sin(s-b)\sin(s-c)}{\sin s\sin(s-a)}$$

deduce the second and fourth of Napier's analogies.

*Alternatives.

5. In a spherical right triangle, $a = 115° 25' 30''$, $b = 165° 33' 25''$; find the other parts. What is a quadrantal triangle, and how are the formulas for its solution derived?

6. $A = 110° 20' 30''$, $B = 78° 29' 30''$, $c = 48° 30' 30''$. Find C and b.

7. Given $t = 2^h 35^m 28^s$, $d = 13° 5' 30''$ N., $L = 30° 20' 30''$ S., find h and Z

8. $A = 45°$, $B = 105°$, $a = 45° 30'$; find C and b, and make a projection of the triangle, using only given parts in the construction.

9. Find Z when $h = 44° 59' 30''$, $d = 30° 02' 10''$ N., and $L = 29° 45' 30''$ N. Make a projection of this triangle on the plane of the meridian, using only given parts in the construction.

ANALYTICAL GEOMETRY.

MONTHLY EXAMINATION.

FEBRUARY 14, 1874.—*Time allowed, two and a half hours.*

1. Construct the locus of each of the equations $y - 2x + 2 = 0$, and $x^2 + y^2 + 10x - 8y = 23$ on the same axes (unit, $\frac{1}{8}''$). Find the co-ordinates of the centre of the curve and the co-ordinates of the points of intersection of the two loci.

2. Construct the locus of the equation $9y^2 + 6xy + 36y + x^2 + 48x - 108 = 0$ (unit, $\frac{1}{4}''$). Find what this equation becomes when the origin is moved to the point $(0, -6)$. Through what angle must the axes be revolved in order that a diameter may be parallel to the axis of X?

3. Construct the locus of the equation $64y^2 + 16xy - 160y - 24x^2 + 80x + 200 = 0$ (unit, $\frac{1}{4}''$); and find the co-ordinates of the centre.

4. Construct the locus of the equation $36y^2 - 24xy + 29x^2 - 180 = 0$ (unit, $\frac{1}{2}''$); and find what the equation becomes when the axes are revolved through $\cos^{-1}\frac{4}{5}$.

5. What locus is represented by the equation $x = y$? by $r = 10$? by $\theta = \tan^{-1}\sqrt{3}$? Deduce the equation to the straight line in terms of its intercept on the axis of Y and the direction-ratio. Deduce the equation to the straight line in terms of the intercepts. Find the angle between the two lines $4y - 3x + 7 = 0$, and $3y - 4x + 9 = 0$.

MONTHLY EXAMINATION.

APRIL 24, 1874.—*Time allowed, two and a half hours.*

1. Define the *cardioide*, the *lemniscata*, the *cissoid*, and the *conchoid*. Deduce the rectangular equation to the latter, and thence the polar equation. Show by sketches the different forms this curve may assume.

2. Two fixed lines make an angle a with each other. A line of fixed length moves with one of its extremities in each of the fixed lines; taking these fixed lines as axes, deduce the equation to the locus of a point on the moving line, the distances of the point from the ends of the line being a and b.

3. Define the common cycloid and the curtate and prolate cycloids, and make a sketch of each. What is an epi-cycloid? a hypo-cycloid? Deduce the equation to the common cycloid. Make a sketch of the locus of the equation $y = a \text{ ver sin } \frac{x}{a}$; what is thi locus called?

4. Find the locus of the point in which the perpendicular from the center of an equilateral hyperbola upon a tangent meets the ordinate to the point of contact. Find the locus of the point in which the perpendicular from the vertex of a parabola upon a tangent meets the ordinate to the point of contact.

5. Trace the locus of each of the following equations: (1) $y^2 = a^2(x^2 - x^4)$; (2) $y^3 = ax^2 - x^3$; (3) $r = a \cos 2\theta$.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, five hours.*

1. Find the equation to the circle passing through the three points $(-3, 9)$, $(-2, 8)$, and $(-10\ 2)$, its radius, and the co-ordinates of its centre. Find the equations to

the straight lines joining these points, and the angles and area of the triangle so formed.

2. Give a general definition of a conic. Define the hyperbola, and deduce its rectangular equation in its simplest form. Show what this equation becomes in terms of p and e, when the origin is taken at the right-hand focus. Discuss the result, giving different values to e, and illustrate by diagrams.

3. Deduce the equations to the tangent and normal to the ellipse in terms of the direction-ratio, and also in terms of the co-ordinates of the point of contact, (x_1, y_1). Deduce expressions for the subtangent and subnormal.

4. Define *diameter* and *conjugate diameters*. Deduce the equation to the parabola, taking for axes any diameter, and the tangent at its vertex.

5. Find the locus of the foot of a perpendicular let fall from a focus of the ellipse, upon a tangent; of the intersection of perpendicular tangents to the hyperbola; and of the foot of a perpendicular let fall from a point in the circumference of the circle upon the tangent.

6. Explain what is meant by *the eccentric angle*, and show how the eccentric angle of a point on an ellipse may be constructed.

Find the relation between the direction-ratios of conjugate diameters of the ellipse.

In the ellipse $a^2 y^2 + b^2 x^2 = a^2 b^2$, find the equations to a pair of conjugate diameters, one of which passes through the point (b, a).

7. State what locus is represented by each of the following equations:

$$xy + x^2 - y = 0 \qquad y^2 - 2xy - 3x^2 - 2y + 7x - 1 = 0$$
$$(x + y)^2 = 2(x - y) \qquad y^2 - 5xy + 6x^2 - x - y - 12 = 0$$
$$x^2 + xy + y^2 = 25,\ 4 \qquad y^2 - 4xy - 16y + x^2 + 17x - 20 = 0$$

Construct the locus of the last equation. Construct the axes and directrix of this locus, and draw a tangent to it at the point (0, 5). Write the equation to this tangent.

8. The distance from a vertex of a hyperbola to the nearest focus is 1.0, and the double ordinate through the focus is 4.5. Find the equation to this hyperbola referred to its axes. Find the equations to the asymptotes, and the equation to the conjugate hyperbola. Find the equations to tangents to the given hyperbola passing through the positive extremity of its conjugate axis.

9. Trace the locus of each of the following equations:

$$a^3 y = a^2 x^2 - x^4$$
$$r = a \cos 3\theta$$
$$x^3 + y^3 - 3axy = 0$$

Find the equations to the asymptotes of the curve represented by the equation—

$$xy^2 = 4x^3 + 4x^2 + x + 6$$

10*. The base of a triangle is $2c$, and the product of the other two sides is m^2. Taking a perpendicular to the base, at its middle point, as the axis of ordinates, find the equation to the locus of the vertex.

Find the polar equation to this locus in the particular case when $m = c$, and trace the curve.

10*. Find the locus of the intersection of a tangent to a conic section with a straight line drawn through the focus at right angles to the radius-vector of the point of contact.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

CHEMISTRY.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, four hours.*

1. Define chemistry in terms of the modern theories of the molecular and atomic constitution of matter. What is the meaning of analysis and of synthesis in chemistry?

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* Alternatives.

2. How many cubic metres of air would be required by a blast-furnace consuming coal equivalent to 20 metrical tons of carbon per diem?

3. What is meant by galvanic protection of metals by each other? Discuss the principle involved, and illustrate by practical examples.

4. Explain the chemical principles of photography, and describe the usual process.

5. Explain the cause and means of prevention of the incrustation of steam-boilers: (1) when fresh water is used; and (2) when sea-water is used.

6. What is the composition of zinc-white, and why is it preferable to lead-paint on ship-board?

7. Why is potassium nitrate preferred to sodium nitrate for making gunpowder? Under what circumstances can the latter be used, and with what advantage?

8. What chemical compounds constitute the ordinary ores of iron, copper, lead, tin, silver, and gold?

9. What are the products of the combustion of illuminating gas, and how much of them, in volume, will a five-foot burner produce per hour?

10. Why is plaster so long in drying or setting, in confined rooms? Discuss the chemical principle involved, and state how the process can be hastened.

11. Explain spectrum-analysis briefly. What special service has it rendered to chemistry?

12. What is steel? Explain the Bessemer process.

DEPARTMENT OF ENGLISH STUDIES, HISTORY, AND LAW.

HISTORY OF THE UNITED STATES.

SEMI-ANNUAL EXAMINATION.

JANUARY 30, 1874.—*Time allowed, five hours.*

[A number marked with an asterisk (*) may be substituted for the same number not so marked.]

1. Colony of Virginia: 1606, 1609, 1612, 1619, 1624. Explain fully the political significance of each of these dates.

1*. Give the history and boundaries of the three divisions of Maine, with dates.

Name the colonies in 1688, and state the form of government in each at that time.

2. Congregationalism, Presbyterianism, Episcopacy. Compare, showing political tendencies.

2*. 1644, 1663, 1840: Rhode Island [*in full*].

3. Name the thirteen acts of Parliament which led directly to the Revolution, giving dates, and referring each to the ministry in which it was passed. Describe any two of these acts.

3*. Four colonial wars: dates; causes; corresponding war in Europe; treaties.

State the territorial changes accomplished by the last three. Connect the last colonial war with the Revolution.

4. (1) Writs of assistance [1761]; (connect with IV. Article of Amendments). (2) Boston Tea-party. (3) Shays's insurrection. (4) Northwest Territory. (5) Mission of Genet. (6) Chesapeake and Leopard. (7) Dred Scott decision. (8) Topeka constitution.

Take four.

5. Second period of the Revolutionary War [April, 1776—July, 1778].

5*. Navy in the War of 1812.

6. Administrations, 1789—1860: Dates; President and Vice-President.

Refer the following to the administrations in which they occur: (1) Embargo; (2) Florida purchase; (3) Tariff compromise; (4) Webster-Ashburton treaty; (5) Gadsden purchase.

6*. Parties, 1830—1860.

7. Connect the Missouri compromise with the Kansas-Nebraska act. Seward said 1854, "The day for compromises is past forever." Explain.

7*. Webster, Jackson, Calhoun: three theories of the Constitution and the Union.

8. Explain the continuity of American institutions, (1) as to Federalism, (2) as to Republicanism, in the form of a threefold distribution of powers.

8*. Articles of Confederation: origin; duration; defects. How does the Confederation form a break in American history?

9. Explain briefly any four of the following: (1) Cabal; (2) Tariff; (3) Excise; (4) Protective system; (5) Ministerial policy [before 1776]; (6) Squatter sovereignty; (7) Personal liberty bills; (8) Localization of parties.

10. Place (1) Fort du Quesne, (2) Louisburg, (3) Eutaw Springs, (4) Plattsburg, (5) Nueces River, (6) Mesilla Valley.

Fix the boundaries of the territory from which slavery was excluded by the Missouri compromise.

RHETORIC.

ANNUAL EXAMINATION.

MAY 25, 1874.—*Time allowed, five hours.*

[* Starred questions are alternatives.]

I.

1. State, in your own language, the aims of linguistic science.

2. What was the old theory of the origin of language, and how did it come to be rejected?

3. Explain fully the ethnographical theory of the growth of languages.

I*.

1. Explain the names used to designate the Indo-European family of languages.

2. Name the seven groups of this family, and classify the sub-groups under each head, stating where and by whom the languages mentioned are spoken, and designating those that are extinct.

II.

Compare the influence of Latin on early English with that exerted on the language of Gaul, and state the historical reasons for the difference.

II*.

1. Describe the policy of the Norman conquerors of England, and from this explain in full the extent and character of Norman influences on the language.

2. Name and describe the two classes of Latin words that have found their way into English.

III.

1. What is meant by purity of diction?

2. Name and characterize the four kinds of barbarisms, and point out the objections in each case.

III*.

1. Name and define the three essential qualities of style.

2. What is meant by the "suspended animation" of words?

IV.

State in full the points to be considered in order to attain (1) clearness, (2) emphasis.

V.

1. What is meant by strength in a sentence?

2. What is the objection to redundancy?

3. What is the effect of frequent intensives?

4. Explain the phrase *splitting particles*, and show how the error thus designated is to be avoided.

VI.

1. "The cares that infest the day
Shall fold their tents like the Arabs,
And as silently steal away."

Explain both the figures.

2. "Some characters cannot determine on any course of action, because they are always standing at the cross-roads, and see the disadvantages of every one of them."

Explain the figure.

VII.

1. "The sun of liberty is set; Americans must light the lamp of industry and economy."

Turn the metaphor into a simile.

2. "Take arms against a sea of troubles."

Point out the fault.

3. "American life is *orphaned* of all the sweet delights of antiquity."

Explain the figure in this sentence, and the meaning of the word in italics.

VIII.

1. Explain *antithesis, epigram, asyndeton, paradox, synecdoche, mixed metaphor.*
2. Give two explanations of the origin of figures.
3. What is the effect of the excessive use of metaphors?

IX.

Write a detailed report of the grounding of a United States vessel, while under your command, on Nantucket Shoals, and describe the means employed in getting the ship off.

IX. question has double weight.

Papers to be submitted, folded, and endorsed according to regulations.

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

ANNUAL EXAMINATION.

MAY, 1874.—SPECIMEN QUESTIONS.

Translate into French:

I.

The axis of the earth is an imaginary line passing through the centre, upon which the whole earth turns; the poles are the extremities of the axis.

II.

Of all living creatures, man is the only one that has not his face turned toward the ground; he walks with his forehead turned toward heaven.

III.

Upon the ocean-path, along which one sees neither trees, nor villages, nor cities, nor tombs, the meeting of two ships is a memorable event.

IV.

The generals were mounted on beautiful horses and wore velvet hats, ornamented with large jewels; the lieutenant-colonels had gold crosses hanging from their button-holes; and the noblemen wore green satin coats with large silver buttons.

V.

A beautiful woman has a powerful charm which excites our admiration; she attracts our admiration by the regular qualities of body, and the agreeable union of the rose and lily in her complexion: a pretty person interests us by her pleasing manners.

ORAL EXAMINATION.

1. How is a phrase rendered negative in French?
2. Explain the rules of contraction and elision.
3. If a noun is taken in a partitive sense, and is preceded by an adjective, does it require any preposition?
4. What is the place of adjectives in French?
5. Give some adjectives which do not follow the general rule of position.
6. Tell all about demonstrative pronouns and their variations.
7. How do nouns and adjectives form their plural?
8. How do adjectives agree with the nouns qualified?
9. What part of speech follows adverbs of quantity?
10. Is the relative pronoun *que* or the conjunction *que* ever omitted in French?
11. In speaking of the days of the month, what numbers do the French employ? What verb is used in speaking of the time of day?
12. Give the conjugations and their terminations.
13. Give the idioms formed with the verb *avoir*.
14. Give the idioms formed with *aller* and with *faire*.
15. State the place of pronouns when used as objects.
16. What words are placed before titles and designations of relationship, in respectful address?
17. Define a *unipersonal verb*, and give examples.
18. What is the place of adverbs in French?
19. What are reflective verbs? Conjugate one.
20. What is the meaning of *se passer*? Of *se servir*?
21. Explain the agreement of past participles.
22. How are passive verbs formed in French?
23. Explain the imperfect tense and its use.
24. Explain how compound nouns form their plural.

Translate into English:

Pendant le siége d'Anvers, en 1832, les deux fils aînés du roi, les ducs d'Orléans et de Nemours, se distinguèrent par le courage avec lequel ils partagèrent les dangers et les fatigues du siége. Un jour que le duc d'Orléans était à la tranchée, les balles parties des remparts sifflaient si près des soldats que par un mouvement involontaire plus d'un baissait la tête. Le prince s'avança au milieu d'eux: "Soyez tranquilles, mes amis, les Hollandais tirent trop haut. Voyez, je suis plus grand que vous, et leurs balles ne me touchent pas la tête." Et cependant plus d'une balle vînt frapper juste pendant une demi-heure environ que le jeune duc resta au milieu des soldats, s'entretenant avec eux, et leur donnant l'exemple du sang-froid.

Conversation: Conjugation of verbs.

SECOND CLASS.

DEPARTMENT OF SEAMANSHIP.

SHIP-BUILDING.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1874.—*Time allowed, four hours.*

1. Describe building-slips (permanent and temporary) and building-blocks. Describe the keel, and explain the manner of scarfing the different lengths together. Describe the stem and stem-framing, and explain the manner of uniting them to the keel.
2. Describe the frame, and explain fully the manner of uniting the different pieces. Raise and regulate the frame of a ship.

Describe diagonal bracing and state its use.

3. Describe the forward and after cants, the hawse-pieces and knight-heads, the side and centre counter-timbers, and state the use of each. Explain breast and deck hooks, and state the uses of each. What are chocks? fillings? State the uses of each.

4. Describe a deck-beam, and state fully its uses and the manner of securing it to the ship's side. Explain the manner of framing a deck. State what is meant by a deck-plan, and tell what it must show.

5. Describe the different bitts in use on board ship. Describe the capstan in general use. Describe the different kinds of rudders now in use. Describe the manner of constructing carvel and clinker-built boats.

6. Describe the different kinds of docks used for docking vessels in this country.

7. The ship being completed, construct the ways and cradle for launching her. Describe each fully.

8. All preparations being made, at the proper time launch the ship.

NAVAL TACTICS.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, four hours.*

1. Explain the organization of a fleet of 12 or more vessels, and state the position of the division and squadron commanders according to rank.

2. Name and describe the three general formations of a fleet. State when a fleet in line or column is in *natural* order, and when in *reverse* order. When is a fleet in *double échelon* in the *natural* order? when in the *reverse* order? when in *inverted* order? and when in *reverse inverted* order?

3. State the distance between vessels at half distance, close order, and open order. [Construct a table.]

4. The fleet being in column of vessels, abreast by divisions, in natural order, heading north, change direction to any course to the northward of east or west, preserving the natural order.

5. With the fleet in line, if signal be made "From the right of fleet form column of vessels, fleet right oblique, right vessel forward," what will be the relative speed of the right vessel, and any vessel on her left? Explain by diagram.

6. State, and explain by diagram, the rule for keeping away to re-form the column on shift of wind, (1) when the wind hauls ahead, (2) when the wind veers aft.

7. Fleet in column of vessels, on starboard tack, in natural order, change to columns of vessels, abreast by divisions, in natural order, on the other tack.

8. Fleet in column of vessels under sail, change to double échelon from the centre vessel, heading 8 points to leeward.

SEAMANSHIP.

ORAL EXAMINATION; SPECIMEN QUESTIONS.—MAY, 1874.

I.

1. By the wind, heave to, to sound; to lower a boat.
2. Set top-gallant sails, moderate breeze, yards braced up.
3. Send down top-gallant and royal yards. (Port routine.)
4. Make preparations for heaving up an anchor.
5. Reeve lower studding-sail clewline.
6. Measure for fore-stays.
7. Rig a bowsprit.

II.

1. Take two reefs in the courses.
2. Set a mainsail, moderate breeze, yards braced up.
3. Secure yards for purchasing a sheet-anchor.
4. Get the anchors off the bows.
5. Reeve topsail reef-tackles.
6. Shears alongside, get them on board and rig them.
7. Set up topmast backstays.

III.

1. Wind on port quarter, and veers directly aft: what is to be done?
2. Set a lower studding-sail.
3. Bend topsails, courses, jib, and spanker.
4. Make up a topmast studding-sail when bent.
5. Reeve a mizzen-royal brace.
6. Measure for and fit jib-guys.
7. Sway a topsail yard on board.

IV.

1. Wear ship short around.
2. Take in a mainsail, moderate breeze, yards braced up.
3. Boat alongside, manned, take charge, pull away from the ship; give all the orders and state how they are executed.
4. Get chains on board and secure them.
5. Reeve jib down-haul.
6. Shears being in place, mizzen-mast on shore, hoist it on board and step it: (ship in the stream.)
7. Measure for and fit royal backstays.

V.

1. By the wind, man falls overboard; what is to be done?
2. Take in the topsails, as in coming to an anchor.
3. Describe, in detail, the manner of crossing a royal yard.
4. Range a chain-cable.
5. Reeve flying-jib halyards.
6. Measure for and fit top-gallant shrouds.
7. Send aloft and rig a top-gallant studding-sail boom.

VI.

1. Wear ship, under all plain sail, fresh or moderate breeze.
2. Set the courses, moderate breeze, yards braced up.
3. Hoist out launch, port side.
4. Bend a chain-cable.
5. Reeve a main brace.
6. Reeve laniards and set up lower rigging.
7. Hoist a jib-boom on board and point it.

VII.

1. Tack ship, under double-reefed topsails, courses, jib, and spanker.
2. Haul down and stow the jib, blowing fresh.
3. Get guns on board through the gun-deck ports.
4. Bring to on a cable.
5. Reeve fore brace.
6. Stay lower masts.
7. Topmast pointed: rig it.

VIII.

1. Before the wind, heave to, with fore-topsail to the mast.
2. Take in a foresail, before the wind.
3. In a boat, station the crew for reefing, and reef.
4. Describe a chain-messenger, and the manner of using it.
5. Reeve topsail buntlines.
6. State in what order the rigging goes over the fore-topgallantmast head.
7. Ship a topmast-cap.

IX.

1. Before the wind, heave to, with the main topsail to the mast.
2. Set a foresail before the wind.
3. Boat pulling for the ship; you are in charge, come alongside, give all the orders, and state how they are executed.
4. Describe iron nippers, devil's claws, and stoppers.
5. Reeve main buntlines.
6. Rig the fore royal funnel.
7. Rig a spanker-gaff.

X.

1. By the wind, under all sail, to reduce sail to a squall.
2. Set a foresail, moderate breeze, yards braced up.
3. Transport an anchor from the waist to the bow.
4. Secure an anchor for sea.
5. Reeve spanker-sheets.
6. Ship in the stream; make preparations for getting shears on board.
7. Rattle-down lower rigging.

DEPARTMENT OF ORDNANCE AND GUNNERY.

INFANTRY TACTICS.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1874.—*Time allowed, four hours.*

1. Give the formation of a regiment in order of battle, with posts of all commissioned officers and non-commissioned officers.
2. Describe the position of carry arms; the change from carry to support; from support to right shoulder shift; from right shoulder shift to carry; from carry to secure; from secure to carry.
3. Fire by company; by rank; by file.
4. Form company, count fours, and complete left fours.
5. Wheel from a halt while on the march.
6. Form column of twos, from fours, and re-form column of fours.
7. Execute fours-right-about in column and in line.
8. Being in column of fours, form line to the front.
9. State the different ways of deploying a company as skirmishers.
10. Rally by fours; rally on centre skirmisher; assemble on centre skirmisher.

GUNNERY.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, four hours.*

1. *Production of gun-iron.* Describe the processes of obtaining pig-iron from the ores. Describe the blast-furnace, and the method of working it; character and effect of different blasts; chemical action in the furnace.
2. Define wrought iron. Describe the refinery, and the puddling-furnace; the method of rolling armor-plates from puddle-balls.
3. Define steel. How is it classified? Describe the processes of production of the different classes. Describe the Bessemer process.
4. Give the details of the manufacture of the XV-inch gun; the preparation of the mould, core, and pit; the method of charging the furnace and melting down the charge; casting; cooling.

DEPARTMENT OF ASTRONOMY AND NAVIGATION.

ASTRONOMY.

MONTHLY EXAMINATION.

MARCH 25, 1874.—*Time allowed, two hours.*

1. Find an expression for the aberration of light in terms of the velocity of the earth in its orbit, of the velocity of light, and of the apparent direction of the body. Define diurnal aberration and annual aberration. If the maximum value of aberration is 20″.4, what is the velocity of light?

2. Define sidereal day; solar day; sidereal time; solar time. Give the value of a sidereal year in sidereal and solar days. Show the difference between the Julian and the Gregorian calendar. Which is now in use?

3. Give the general laws of the tides so far as the moon is concerned. Define *common* and *corrected* establishment, and state how the time of high water at a given place is found by means of the corrected establishment. Of the two daily tides, which rises higher? When does the highest tide occur, and what is it called? When does the lowest tide occur, and what is it called?

4. Give Newton's law of universal gravitation. What is the mass of the sun, and how is it found? Define astronomical and civil time.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, five hours.*

1. Define vertical circles; celestial equator; prime vertical; hour-circle; declination; right ascension; celestial latitude and longitude; sidereal day; solar day; sidereal time; solar time; sidereal and tropical year; synodical period; amplitude; right ascension of the meridian; geocentric and heliocentric parallax; azimuth; altitude astronomical time; and civil time.

2. Discuss fully the equation of time. Define it in terms of the sun's longitude and right ascension as well as in hour-angles. At the autumnal equinox, what is its sign of application to apparent time? Give the reasons for your answer.

3. Give the facts and experiments that lead to a positive knowledge that the earth rotates on its own axis.

4. Name the different kinds of lunar eclipses. Find an expression for the semi-angle of the umbral cone; for the angular semi-diameter of the shadow at the distance of the moon; for the length of the earth's shadow; and for the lunar ecliptic limits in terms of parallax and semi-diameter. State when an eclipse must occur.

5. Show how to find the inclination of a planet's orbit to the plane of the ecliptic. How is the distance of a *superior* planet from the sun found from observations made at the time of opposition? Deduce the formula for finding the approximate mass of a planet which is attended by a satellite.

6. Explain the method of determining the latitude of an observatory by means of a circumpolar star, and the methed of finding the latitude of a station of a survey by means of two stars.

Why is the first used at observatories, and the second at stations of a survey?

DEPARTMENT OF PHYSICS AND CHEMISTRY.

ELECTRICITY.

ANNUAL EXAMINATION.

JANUARY, 1874.—*Time allowed, five hours.*

1. Describe the construction and action of the electrophorus, and of the Carré electrical machine.

2. Describe Thompson's electrometer, and explain its action. What was Faraday's theory of induction?

3. How may the condensing force of the Epinus condenser be calculated? Show how Wheatstone measured the duration of the electric spark, and the velocity of electricity in a wire.

4. What causes the polarization of electric batteries, and what means are used to prevent it in Daniell's, Grove's, and Bunsen's batteries? Describe Grove's battery, and the chemical reactions that take place while it is in action.

5. Discuss Ohm's law.

6. How should a battery of 45 cells, each with an internal resistance of 2 units, be set up in order to overcome an external resistance of 11 units? What are the four most important of Faraday's laws of electrolysis?

7. What is Ampère's theory of magnetism? Give briefly the history of the electric telegraph. Describe the Morse telegraphic apparatus and its action.

8. Prove that the intensities of currents are proportional to the tangents of the corresponding angles of deflection of the tangent-galvanometer needle. What are the laws of the heating effects of the electric current?

9. Explain the inductive action of magnets on bodies in motion. Explain how a magnet may be made to rotate by a current from a battery.

10. What is diamagnetism? What would be the effect upon a thermo-electric pile, if a current from a battery were passed through it?

11. What is the cause of the magnetization of iron ships? How may the influence of this magnetism be compensated?

MECHANICS.

MONTHLY EXAMINATION.

NOVEMBER, 1873.—*Time allowed, two hours and fifteen minutes.*

1. Deduce the relation between the power and the weight in the case of the lever with friction.

2. Apply the same method to finding the force exerted at the end of the elevating screw in depressing an XI-inch gun, the centre of gravity of the gun being 2″ in rear of the axis of the trunnions, and the elevating screw 3′ 4″ from the same point; diameter of trunnions, $9''\frac{3}{4}$; weight of gun, 16750 pounds; co-efficient of friction, $\frac{5}{12}$.

3. A right prism of cast iron, having a base 2′ square, rests on an inclined plane of oak, and is on the point of both overturning and sliding down; find the height of the prism, the co-efficient of friction between oak and cast iron being 0.65.

4. It is found that a man pulling 125 pounds on a double Spanish burton, which leads at an angle of 30° with the deck, which is horizontal, can just move a weight along the deck, the co-efficient of friction between the weight and the deck being $\frac{1}{\sqrt{3}}$; required the weight.

5. Find the least force necessary to draw a weight of 25 tons up a rough inclined plane, μ being $\frac{5}{12}$, and the inclination of the plane being such that 7 tons acting along the plane would support the weight if the plane were smooth.

MECHANICS AND DIFFERENTIAL CALCULUS.

SEMI-ANNUAL EXAMINATION.

JANUARY 26, 1874.—*Time allowed, five hours.*

MECHANICS.

1. Find the ratio between the power and the weight in the case of Hart's elevating screw; explain briefly how each equation is derived from the preceding equation.

2. A cord made fast at one extremity A passes under a movable pulley B sustaining a weight of 13 pounds, and then over a fixed pulley, C, and has a weight of 10 pounds

made fast to the other end, the end A and the fixed pulley C being in the same horizontal plane; find the length of the cord A B C when the system is in equilibrium, the size of the blocks being neglected, and A C being 6 feet.

3. The foot of a frigate's main topsail is 90 feet long, and the head 70 feet long; find the hoist in order that the centre of effort may be $28\frac{3}{4}$ feet above the foot.

4. A solid is formed of a hemisphere and a cone having a common base; find the height of the cone when the solid rests in equilibrium on any point of the spherical surface.

5. A capstan has 8 bars, each projecting 8′ from the axis; the barrel, around which the the rope has 3 turns, is 14″ in diameter, and the rope is 2″ thick; a man exerting a force of 60 pounds heaves on the end of each bar, the co-efficient of friction being $\frac{1}{8}$, and π $\frac{22}{7}$; find the tension on each end of the rope in hoisting a weight.

6. A hemisphere rests with a point in the circumference of its base upon a rough horizontal plane, and a point in the convex surface in contact with a rough vertical wall; the co-efficient of friction between the wall and the solid being the same as that between the floor and the solid; find its value, supposing the hemisphere just supported with its base in a vertical plane.

7. At what distance from a hatch-coaming must a shot-rack for a 11″ shot be placed in order that the shot may not topple out until the ship is heeled more than 45° ?

DIFFERENTIAL CALCULUS.

1. Deduce the differential of $\log x$, determining the constant.

2. The work of driving a steamer through the water being proportional to the cube of her speed, find her most economical rate per hour against a current running a knots per hour. (*For Cadet-Engineers only.*)

3. Differentiate the functions:

$$u = \frac{x}{a^2\sqrt{a^2-x^2}},$$

and

$$u = \log x + \sqrt{a^2+x^2}.$$

4. Differentiate

$$u = \log \tan \left(\varepsilon^{\sqrt{x}}\right),$$

and

$$u = \frac{1}{\sqrt{3}} \tan^{-1} \frac{2x-1}{\sqrt{3}}.$$

5. A high vertical wall is to be supported by a shore which must pass over another wall $6'\frac{3}{4}$ high, and 16′ distant from the first wall to which it is parallel. What is the length of the shortest beam that can be used for this purpose?

6. A steamer, whose speed is 8 knots per hour and course due north, sights another steamer directly ahead, whose speed is 10 knots and whose course is due west. What must be the course of the first steamer to cross the track of the second at the nearest possible point?

7. A nun-buoy is constructed of boiler-iron in the form of two equal cones having a common base. Find the ratio between the altitude and the radius of the base of each cone, in order that the buoy's buoyancy may be the greatest possible.

8. Derive the logarithmic series—

$$\log(x+1) = \log x + 2\left\{\frac{1}{2x+1} + \frac{1}{3}\frac{1}{(2x+1)^3} + \frac{1}{5}\frac{1}{(2x+1)^5} + \&c.\right\}$$

9. Given $\log_\varepsilon 2 = 0.6931472$, and $\log_\varepsilon 3 = 1.0986123$, and $\log_\varepsilon 5 = 1.6094379$, find $\log_\varepsilon 271$.

10. The top-gallant sail being furled, and the top-gallant sheets taut, show that it is necessary to slacken the sheets in *hoisting* the topsail-yard, but that they may be kept taut when *lowering* it. (*For Cadet-Midshipmen only.*)

INTEGRAL CALCULUS.

MONTHLY EXAMINATION.

FEBRUARY 26, 1874.—*Time allowed, two hours and twenty minutes.*

[Any one of the first three questions may be omitted.]

1. $\int_0^{2a} \frac{x\,dx}{\sqrt{2ax-x^2}}$ and $\int \frac{dx}{1+\cos x}$.

2. $\int \left\{ \log \frac{x}{a} \right\}^3 dx$ and $\int \frac{dx}{\cos x}$.

3. $\int (x^8+a^3)^{\frac{7}{2}} x^{15}\,dx$ and $\int \frac{dx}{\sqrt{1-3x-x^2}}$.

4. Find the centre of gravity of a paraboloid and of a hemisphere.

5. Find the whole area of a curve whose equation is $y^2=x^2(25-x^2)$; and find the area of a cycloid.

6. Find the volume generated by the revolution about the axis of x of the curve whose equation is $y^2(a^2+x^2)=a^2x^2$, between the limits a and 0. Find also the volume of a frustum of a cone, in terms of the radii of the two bases and the distance between them.

MECHANICS AND APPLIED MATHEMATICS.

MONTHLY EXAMINATION.

MARCH, 1874.—*Time allowed, four hours.*

1. Define work and unit of work. Deduce an expression for the work accumulated in a body moving with any velocity. Find the work done in moving a body through any space up a rough inclined plane.

2. Deduce the equation to the trajectory of a projectile in a non-resisting medium. Find the greatest height reached, time of flight, and range, on a horizontal plane.

3. (*a*) Two projectiles fired from the same point, with the same initial velocity, but at different angles of elevation, have the same range on a horizontal plane; find the ratio of the times of flight. (*b*) A shot is 600′ above the horizontal plane at 800′ from the gun, and strikes the plane at 3200′; find the angle of elevation and the initial velocity.*

4. A body weighing 5 pounds, resting on a rough horizontal table, (co-efficient of friction, 0.5,) is connected by a string passing over a fixed smooth pulley at the edge of the table, with a weight of 10 pounds, which is free to descend vertically; find the vertical and horizontal components of the acceleration of the motion of the centre of gravity of the system.

5. A horizontal plane is descending with a velocity of 32′ per second, when a ball is dropped from a point 48′ above it; the elasticity being perfect, find the distance between the highest point of the rebound and the point from which the ball started.

6. Find the pressure of a man weighing 180 pounds on the car of a balloon, which is rising vertically with an acceleration of 16′ per second.

7. A heavy box, 8′ high and 6′ square, stands on the deck of a ship, with one edge perpendicular to the line of the keel; supposing the box not to slide, what must be the velocity of the ship if, when she is brought up suddenly, the box just topples over?

8. A shot weighing 6 pounds leaves the muzzle of a gun with a velocity of 1,000′ per second; determine the mean pressure of the gases on the shot, if the distance from the seat of the shot to the muzzle be 5′.

9. Find at what rate an engine of 30 horse-power could draw a train weighing 50 tons up an incline of 1 in 280, the resistance from friction being 7 pounds per ton.

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* Take either (*a*) or (*b*).

MECHANICS AND INTEGRAL CALCULUS.

ANNUAL EXAMINATION.

MAY 26, 1874.—*Time allowed, five hours.*

[Any two examples may be omitted.]

1. (*a*) $\int \frac{dx}{\cos x}$, (*b*) $\int \sqrt{2ax-x^2}dx$.

2. (*a*) $\int \frac{4xdx}{x^4-8x^2+16}$, (*b*) $\int \frac{dx}{\sqrt{18x-7x^2}}$.

3. Find an expression for the area common to the curves $x^2=3ay$, $y^2=3ax$, and $y^2=4a^2-x^2$.

4. Find the volume generated by the revolution about the axis of x, of the curve $y^2=a^2x^2(x^2-a^2)$.

5. Find the length of the line joining the centre of gravity of a quadrant with the centre of the circle.

6. Deduce the equation to the loxodromic curve.

7. A body is projected vertically upward from the top of a tower 80 feet in height with a velocity of 96 feet per second; in what time will it strike the ground?

8. Show that the maximum range on an inclined plane of a projectile having a given initial velocity, u, is $\frac{u^2}{g}\left[\frac{1-\sin\beta}{\cos^2\beta}\right]$, in which β denotes the inclination of the plane to the horizon.

9. A ball is projected from a point on a smooth billiard-table and after striking the four sides in order returns to the starting point; show that the sides of the parallelogram described are parallel to the diagonals of the table, the elasticity being perfect.

10. At what elevation must a shot be fired with a velocity of 400 feet that it may range 2500 *yards* on a plane which *descends* at an angle of 30° ?

11. If a clock loses 30 seconds in 12 hours, by what proportional part of itself must the pendulum be shortened?

12. A chain cable 120 fathoms long fills up 8′ of a chain-locker, the bottom of which is 25′ below the main deck on which the chain is to be roused up; how much of the work is done when there are 60 fathoms on deck?

13. Find the centre of pressure of an immersed triangle of altitude h and base b; the base being parallel to the surface, and the apex being between the base and the surface and at a distance a below it.

14. A balloon, when released from the ground, rises with a vertical acceleration of 32′ per second, but when 200 pounds of ballast are thrown out, the acceleration is increased to 36′ per second; the weight of a cubic foot of air is 527.04 grains, and the specific gravity of the gas in the balloon, as compared with air, is 0.4; what is the volume of the gas in the balloon [the air displaced by the car and attachments being neglected]?

DEPARTMENT OF MODERN LANGUAGES.

FRENCH.

ANNUAL EXAMINATION.

MAY, 1874.—SPECIMEN-QUESTIONS.

Translate:

C'est à Francfort qui j'appris à connaitre la vie militaire. Jusque-là je n'avais été qu'un simple conscrit, alors je deviens un soldat, et je ne parle pas ici de l'exercice, non! La manière de faire tête droite et tête gauche, d'emboîter le pas, de lever la main à la hauteur de la première ou de la deuxième capucine pour charger le fusil, d'ajuster, et

de relever l'arme au commandement, c'est l'affaire d'un ou deux mois avec de la bonne volonté. Mais j'appris la discipline, à savoir; que le caporal a raison lorsqu'il parle au soldat,le sergent lorsqu'il parle au caporal, le sergent-major lorsqu'il parle au sergent, le sous-lieutenant au sergent-major, ainsi de suite jusqu'au maréchal de France—quand ils diraient que deux et deux font cinq ou que la lune brille en plein midi.

Cela vous entre difficilement dans la tête, mais quelque chose vous aide beaucoup; c'est une espèce de pancarte affichée dans les chambrées, et qu'on vous lit de temps en temps, pour vous ouvrir les idées. Cette pancarte suppose tout ce qu'un soldat peut avoir envie de faire, par exemple de retourner dans son village, de refuser le service, de résister à son chef, etc., et cela finit toujours par la mort ou cinq ans de boulet au moins.

Le lendemain de notre arrivée à Francfort, j'écrivis à M. Goulden, à Catherine et à la tante Grédel; on peut se figurer avec quel attendrissement. Il me semblait, en leur parlant, être encore au milieu d'eux; je leur racontais mes fatigues, le bien qu'on m'avait fait à Mayence, le courage qu'il m'avait fallu pour ne pas rester en arrière. Je leur dis aussi que j'étais toujours en bonne santé, grâce à Dieu; que je me sentais plus fort qu'avant de partir, et que je les embrassais mille et mille fois.

ORAL EXAMINATION.

1. Explain the rules of contraction in French, with examples.
2. Explain the rules of elision, with examples.
3. Explain the use of the partitive articles.
4. How many conjugations are there in French?
5. How are they distinguished from each other?
6. How many simple tenses are there?
7. Name the primitive tenses.
8. Is there any difference between *tromper* and *se tromper?*
9. Explain the meaning of the expression *s'en aller?*
10. When do past participles vary?
11. Define a unipersonal verb, and give examples.
12. Explain the use of the imperfect and past definite tenses.
13. Explain how compound nouns are pluralized.
14. Is the verb *faire* used in an idiomatic sense? If so, give an example under each case.
15. Is *mettre* or *se mettre* used idiomatically? Give an example under each head.
16. Give the ordinal numbers as far as fifty.
17. What verb is used in speaking of age?
18. In speaking of a person's health, what verb is used?
19. Explain the use of the subjunctive mood.

Nautical phrases. *Translate into English:*

1. "Tout le monde en haut pour diminuer de voiles."
2. Sur la perpendiculaire de notre route.
3. L'équipage sait bien faire les exercices.
4. "Haut la main, hardi."
5. Entre deux eaux.
6. "Brassez légèrement sous le vent."
7. Un coup de vent emporta notre misaine.
8. Dégagez ce palan.
9. Veillez le sillomètre.
10. Il nous lacha une bordée en passant.
11. Ho, de la hune de misaine.
12. Près et plein.

13. Bordez les écoutes tout plat.
14. L'amiral porte le pavillon au grand mât.
15. Courir babord au vent.
16. On arme une escadre à Brooklyn.
17. Amarrez partout. Lof tout.
18. C'est l'heure de la haute marée.
19. Tapez les canons. Avant tribord.
20. Armez ce canot. Accostez, patron.

Translate into English extempore :

Après avoir servi dix-sept ans sous différents généraux, Turenne fut fait maréchal de France à 32 ans. Rien ne lui faisait plus d'honneur que l'aveu de ce qu'il croyait devoir à chacun de ses maîtres. Il disait, "qu'il tenait du prince Frédéric-Henri d'Orange, son oncle, les principes de bien choisir un camp, d'attaquer une place dans toutes les règles, de former un projet, de le rouler longtemps dans la tête, et de ne rien faire paraître qu'au moment de l'exécution; d'être dépouillé d'ostentation, et de se remplir de sentiments vifs et relevés pour l'intérêt de la patrie plutôt que pour sa propre gloire." En parlant du duc de Weimar, il disait "que de rien ce général faisait toutes choses et ne s'en orgueillissait pas de ses succès; que, lorsqu'il avait du malheur, il ne songeait pas tant à se plaindre qu'à se relever; qu'il aimait mieux se laisser blâmer injustement que de s'excuser au dépens de ses amis qui avaient manqué dans l'action; qu'il était plus occupé à réparer ses fautes qu'à perdre son temps en apologies; et, enfin, qu'il cherchait plus à se faire aimer par les soldats, qu'à s'en faire craindre." Il avait remarqué sous le cardinal de La Valette, "que, pour être agréable aux militaires, il fallait, en allant à l'armée, renoncer aux fausses délicatesses de la cour, à la galanterie, aux amusements du bel esprit, et vivre avec les officiers à leur mode, sans façon et sans affectation. Il fut confirmé, en voyant la conduite du comte d'Harcour, dans la grande maxime de César, que de toutes les vertus militaires, la diligence et l'expédition sont les plus essentielles, et qu'elles entraînent ordinairement le succès quand elles sont accompagnées de circonspection et de prudence."

Conversation, entirely in French.

FIRST CLASS.

DEPARTMENT OF SEAMANSHIP.

PRACTICAL SEAMANSHIP.

ORAL EXAMINATION, SPECIMEN-QUESTIONS, MAY, 1874.

I.

1. Make preparations for loosing sails to a bowline, topgallant and royal yards across.
2. Ship under courses, topsails, topgallant-sails, jib, and spanker: tack ship.
3. Set a mainsail; moderate weather; wind on the quarter.
4. Carry out a stream-anchor.
5. Haul down and stow the jib; strong breeze.
6. What lights must ships at anchor show? What lights do pilot-vessels carry?
7. Define an ebb-tide.

1. Riding to a windward tide, wind aft, get under way and stand out before the wind.
2. Hove to, with main-topsail aback; fill away.
3. Take in all the starboard studding-sails.
4. Hoist in guns through a gun-deck port.
5. Set mainsail; fresh wind; yards braced up.
6. How does a ship, trimmed by the head, carry her helm?
7. Define a spring-tide.

III.

1. Make all preparations for weighing anchor.
2. Ship under all drawing sail, wind aft, man falls overboard: what should be done?
3. Set a jib; fresh wind.
4. Weather topsail-sheet and clewline carried away: what is to be done?
5. Set a mainsail; wind fresh on the quarter.
6. Make a diagram of two vessels, A and B: A sees a green light and a top light three points forward of the port beam; what is each vessel to do?
7. In getting under way, how would you cast, in reference to danger?

IV.

1. Furl sails; topgallant and royal yards in the rigging; sails loosed to a bowline.
2. Wear ship in a very light breeze.
3. Take in a mainsail; moderate weather; yards braced up.
4. Put on a mooring-swivel.
5. Set a jib; fresh breeze.
6. Two sailing-ships crossing so as to involve risk of collision; what is the duty of each?
7. Define a flood-tide.

V.

1. Riding to an ebb-tide; wind abeam; get under way and stand out.
2. Ship lying becalmed; head-yards abox by starboard braces; breeze striking her on starboard bow; what is to be done?
3. Set all the starboard studding-sails.
4. Stow a sheet-anchor.
5. Take in mainsail; fresh wind; yards braced up.
6. Ship comes-to against the helm; box her off.
7. [illegible]

VI.

1. Unbend sails; topgallant and royal yards in the rigging.
2. Wear ship in a moderate or fresh breeze.
3. Take in a mainsail; fresh wind; yards braced up.
4. Moor ship, riding to single anchor, in a tide-way.
5. Set topgallant-sails; moderate weather; on a wind.
6. Two steamships meeting end on, or nearly so, so as to involve risk of collision: what is the duty of each?
7. How is it known when a ship is *full and by* in a light breeze? in a strong breeze?

VII.

1. Under all starboard studding-sails, run in and anchor (no tide).
2. By the wind, heave-to, to speak a vessel.
3. Take in the topsails; blowing fresh; yards braced up.
4. Square yards.
5. Set a lower studding-sail.
6. With plenty of sea-room, wind fair, under what sail would you get a ship underway.
7. Define a windward ebb-tide.

VIII.

1. Loose sails to a bowline, in port, at color-hoisting; topgallant and royal yards across.
2. Tack ship under all plain sail in a very light breeze.
3. Set a mainsail; fresh wind; yards braced up.
4. Carry out a bower-anchor with a launch.
5. Take in all the port studding-sails.
6. What lights do fishing-vessels carry? What fog-signal is used in steamships and sailing-ships, respectively?
7. In bracing up yards, studding-sails set, what gear must be tended?

IX.

1. Ship moored in a tide-way, starboard-anchor up stream, port-anchor down stream, riding to the ebb-tide, with an elbow in the hawse; make all preparations and clear hawse.
2. Under all plain sail, by the wind, struck by a squall; what is to be done?
3. Set and take in royals and flying-jib.
4. Weather foretopsail reef-tackle carries away while reefing; what must be done?
5. Take in a mainsail; blowing fresh; yards braced up.
6. Make a diagram of two vessels, A and B: A sees a green light and a top light three points on port bow; what is each vessel to do?
7. What sail ought a ship usually to carry in coming to an anchor?

X.

1. Make preparations for bending topsails, courses, jib, and spanker.
2. Box-haul a ship.
3. Lying to in a gale, take in a close-reefed maintopsail.
4. By the wind, under all plain sail, wind shifts to the quarter; what is to be done?
5. Set a mainsail; fresh wind; yards braced up.
6. Make a diagram of two vessels, A and B: A sees a red, a green, and a top light, and B sees a red and a green light; what are the duties of each vessel?
7. Trim yards; wind abeam.

DEPARTMENT OF ORDNANCE AND GUNNERY.

FABRICATION OF GUNS.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1874.—*Time allowed, four hours.*

1. Describe the Parrott gun and the method of re-enforcing it.
2. Describe the Armstrong gun and the method of fabrication; leading features; its advantages and defects.
3. Describe the present rifled muzzle-loading gun of the British service.
4. What is the method of re-enforcing guns by hoops with *initial tension?* What by hoops with varying elasticity?
5. What are the advantages and disadvantages of cast-iron guns?
6. What are the benefits arising from hollow castings?
7. Describe the advantages and the disadvantages of wrought iron for guns; strength; uniformity; detection of weakness (in built-up guns); resistance to wear; want of homogeneity; welds; cost.
8. What is the object of rifling? Define and explain the leading systems.

DEPARTMENT OF ASTRONOMY AND NAVIGATION.

NAVIGATION.

MONTHLY EXAMINATION.

DECEMBER 30, 1873.—*Time allowed, four hours.*

1. What is latitude? Deduce the formulas for finding the latitude by a single altitude of a heavenly body off the meridian, the longitude and Greenwich mean time being given. Explain how ϕ'' and ϕ' are marked. When does this method fail at sea?
2. Deduce the formula (ver sin) for finding the latitude by a single altitude of a heavenly body observed near the meridian, the latitude being approximately known, and the longitude and Greenwich time being given. Explain how in this problem the

hour-angle of the sun is found in practice. When the resulting latitude differs widely from that by *dead reckoning*, how would you proceed? Why is the above method ever used in preference to that by ϕ'', &c.? Give the reasons at length.

3. Deduce the formula by which is computed the change in altitude of a heavenly body in one minute from its culmination, its declination and the latitude being given. Why is Bowditch's Table XXXII, which is computed by this formula, left blank when $(L-d)<4^\circ$? How do altitudes vary near the meridian?

4. Deduce the formula (Chauvenet's) for finding the latitude by two altitudes of a heavenly body, observed near the meridian, the hour-angle being unknown, but the elapsed time given. What advantage does this method possess over the ϕ'' method? How is this method limited?

5. Deduce the formula given in Coffin's Navigation for finding the latitude by an observed altitude of the star Polaris. How do you find t in this method? When is $L=h+\phi$? When is $L=h-\phi$? Why is Bowditch's pole-star table now incorrect?

PRACTICAL WORK.

1. December 30, 1873, a. m. Longitude 139° E. Eye, 18 feet above the water. Index-correction of the sextant $-2'\ 00''$. Gr. chro. time, obs. $3^h\ 05^m\ 15^s$; the chro. cor. being $+2^m\ 18^s$. $*$ Sirius, obs. alt. $45^\circ\ 52'\ 00''$, bearing southerly. Required the latitude by the ϕ'', &c., formulas.

2. December 30, 1873. Lat. D. R. 27° 40′ N. Long. D. R. 140° W. Gr. chro. time, obs. $9^h\ 18^m\ 40^s$, $\odot$ obs. $38^\circ\ 44'\ 10''$. Gr. chro. time, obs. $9^h\ 32^m\ 16^s$, $\odot$ obs. $38^\circ\ 38'\ 30''$. Eye, 18 feet above water; index-cor., $-2'\ 00''$; chro. cor., $+4^m\ 11^s$; and daily rate gaining $0^s.3$. Required the latitude by the formula, $h_0=\frac{1}{2}(h'+h'')+$&c.

3. December 30, 1873. Local mean time, $8^h\ 20^m$ a. m.; long., 81° E.; eye, 18 feet above water; index-cor., $-2'\ 00''$; obs. alt. of $*$ Polaris $38^\circ\ 22'\ 10''$. Required the latitude.

THEORY OF NAVIGATION.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, five hours.*

1. Find the rigorous expression for the difference of longitude made by a ship which sails from the equator on a given course, C, until she arrives in a given latitude, L.

2. Deduce the formula for finding the amplitude of a heavenly body when in the horizon of a given place. State how amplitude is named.

Deduce the formula for finding the hour-angle of a heavenly body when on the prime vertical, east; the latitude being of the same name as the body's declination, and numerically greater.

Define the *equation* of *equal altitudes*. What is the necessity for its use?

3. Deduce the formulas for finding the latitude from an altitude of a heavenly body observed at any time, the local time of the observation and the longitude of the place being given. When are observations by this method, for latitude, too inaccurate for use at sea?

Simplify the formulas for use when the star Polaris is observed.

4. Deduce the formula for finding the latitude by two altitudes of the sun observed near noon, the local time being unknown, but when you have a Greenwich chronometer at hand whose error is approximately known.

5. Deduce the formulas for finding, at a given place, the astronomical bearing of a terrestrial object, when the angle between the terrestrial and celestial bodies is measured with a sextant, and the local mean time known.

6. Describe fully the principles of Sumner's method of finding a ship's position at sea.

When the ship has moved between the observations, how do you determine the latitude and longitude at the time of the second observation?

What special use is made of a single line of position? How may the azimuth of the heavenly body be found by means of this single line?

7. Describe fully the method of swinging a ship in a harbor, when a distant landmark is visible, for the purpose of determining the deviation of her compass. How is the amount of deviation found for each point of the compass?

PRACTICE OF NAVIGATION.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, eight hours.*

1. *Day's work:*

(*a*) On May 29, 1873, at 2 p. m., took a departure, Cape Henry light, in lat. 36° 55′ 30″ N.; long. 76° 00′ 12″ W., distant twelve miles, bearing, per compass, W. by N. (the ship's head being east, and the deviation on that point ½ point easterly). Variation from the chart, one point westerly. Thence sailed the following courses, &c.:

Distance.		Compass courses.	Direction of wind.	Lee-way.	Deviation.
Knts.	Fms.				
15	0	N. ¾ E	Southward and eastward	½ point	1¼ points easterly.
25	6	E. ½ N.	do	do	½ point easterly.
22	0	E. by N.	do	do	¾ point easterly.
18	0	W. by N.	Southward and westward	do	2 points westerly.
19	2	S. ¼ W.	do	do	1¾ points westerly.
*15	4	S. by W	do	do	1½ points westerly.

* Run to noon from a. m. sight.

NOTE.—Work to the nearest quarter of a point.

(*b*) At noon, May 30, 1873, observed the merid. alt. ☉ 75° 14′, bearing south; eye, 18 feet above the water; index-cor., —2′ 10″.

(*c*) About 8 a. m., May 30, 1873, observed the altitude ☉, 36° 20′ 40″, eye 18 feet above the water; index-cor., — 2′ 10″; watch-time of obs., $7^h\ 57^m\ 30^s$; chro. — watch, $5^h\ 00^m\ 15^s$; and the chro. cor., + $2^m\ 45^s$. At the same time the ☉'s bearing, per compass, was N. 116° 30′ E., the ship's head being S. by W., and the deviation on that heading 1½ points westerly.

Give for noon, May 30, 1873, the following:

Latitude by *dead reckoning*.

Longitude by *dead reckoning*.

Latitude by observation.

Longitude by observation.

Variation of compass, per azimuth, at 8 a. m.

Course made good.

Distance made good.

Current (amount and direction of).

2. *Equal altitudes of the sun's lower limb, with a sextant and artificial horizon, a. m. and p. m.*

June 1, 1873.—Lat., 30° 20′ S.; long., 170° 00′ 00″ E.

A. M., watch-time of obs., $10^h\ 00^m\ 50^s$; 2 obs., alt. ☉, 70° 00′ 00″.

P. M., watch-time of obs., $1^h\ 39^m\ 50^s$; 2 obs. alt. ☉, 70° 00′ 00″.

Comparisons.

Before going on shore:

	h	*m*	*s*
Chro	4	10	10
Watch	9	20	30

On returning to the ship after the second observation:

Chro	9	28	52
Watch	2	39	20

Required the error of the chronometer on Greenwich mean time.

3. *Astronomical bearing.*

May 30, 1873, a. m.—Lat., 30° 50′ S.; long., $4^h\ 30^m\ 20^s$ W.

Watch-time of observation, $8^h\ 58^m\ 53^s$.

Chro. — watch, $4^h\ 05^m\ 30^s$.

Chro. cor., + $24^m\ 14^s.6$.

At this time measured the angle, with a theodolite, between a light-house and the sun's nearest limb, 12° 14′ 34″; the sun being to the right of the light-house.

Required the sun's *true* altitude, and the *true* bearing of the light-house.

4. *Meridian-altitude of the moon.*

May 7, 1873.—Observed the merid. alt. ☽ 78° 28′ 40″, bearing south. Long., 79° 40′ W. Index-cor., + 2′ 00″. Eye, 18 feet above the water. Required the latitude.

5. Find the time of high water on June 1, 1873, a. m., at Typa Roads, Canton River, in latitude north, and long. 113° 14′ E., the *corrected establishment* being $10^h\ 00^m\ 00^s$.

Which will be the higher tide, this one, or the p. m. tide of the same day?

6. *Finding the error of a chronometer by the transit instrument.*

October 13, 1873, at Annapolis, Md., lat. 38° 58′ 53″ N., long. $5^h\ 5^m\ 57^s.5$ W., the sidereal clock-time of the transit of the star *α Aquilæ* over the—

	h	*m*	*s*
1st wire was	19	00	07
2d wire was	19	00	20.5
3d wire was	19	00	32
4th wire was	19	00	44
5th wire was	19	00	55

The sidereal clock had no rate.

The comparison was:	Sidereal clock	19	02	13
	Chronometer	5	55	30

Required, (1) the error of the sidereal clock on local sidereal time; (2) the error of the chronometer on local mean time.

7. Find the *great-circle* course and distance, by computation, from—

Lat.	37° 02′ S.	}	to	}	Lat.	6° 47′ S.
Long.	12 17 W.	}		}	Long.	105 13 E.

Also find, by *inspection*, the Mercator's course and distance between the same two places.

8. *Latitude by the Pole Star.*

December 22, 1873, at local mean time, $5^h\ 55^m$ p. m., in longitude 162° W., observed the altitude of star Polaris, 79° 10′; eye, 18 feet above the water; index-cor., + 2′ 00″. Required the latitude.

9. *Latitude by an altitude of the sun taken near noon (ver-sin method).*

November 14, 1873.—Approximate latitude, 31° 15′ S.; long., 90° 20′ W. Watch-time of obs., $11^h\ 40^m\ 30^s$; chronometer — watch, $6^h\ 03^m\ 08^s$; chro. cor., — $12^m\ 20^s$; eye, 18 feet above the water; index-cor., — 3′ 10″; and the obs. alt. ☉ 76° 04′ 15″, the sun bearing northerly. What was the latitude?

DEPARTMENT OF PHYSICS AND CHEMISTRY.

HEAT.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1874.—*Time allowed, five hours.*

1. How may the co-efficient of absolute expansion of mercury be determined? Derive the formula for finding the temperature by the weight-thermometer.

2. What is the corrected reading of a barometer that stands at 755mm at 15° C., calling the co-efficient of expansion of mercury $\frac{1}{5508}$? What is the temperature of water at its maximum density, and of what importance is this in the economy of nature?

3. Describe Regnault's method of determining the co-efficient of expansion of air.

4. A cubic decimeter of air weighs 1.205 grammes at 20° C.; what will be the weight of the same volume at 10°? What is the tension of the vapors of mixed liquids? What is meant by "the retardation of the point of solidification"? Give some illustrations.

5. What is the cause of the reduction of temperature by freezing-mixtures, such as

sulphate of sodium with hydrochloric acid and common salt with snow? How may mercury be artificially frozen and alcohol reduced to a viscous state?

6. What five gases have not been liquefied? What is the weight of a volume of air saturated with aqueous vapors at a temperature of 12° C. and pressure of 755^{mm}? (A cubic inch of dry air at 0°C. weighs 0.31 grains, and the density of aqueous vapor is 0.625 as compared with air.)

7. What are the laws regulating the intensity of radiant heat? What becomes of all the heat falling upon the surface of any body? Explain why the specific heat of gases under constant pressure is different from the specific heat under constant volume, and deduce the formula expressing their ratio.

8. If the total length of the steel bars of a gridiron-pendulum be 50 centimeters, how long must the brass rods be that the pendulum may not change its length with change of temperature? (The co-efficient of expansion of steel is 0.0000123; of brass, 0.0000187.) Compute the amount of heat imparted to a room by 15 pounds of steam entering at 100° C., and flowing off condensed to water of 98° C.

9. What is the mechanical equivalent of heat? How has it been determined experimentally by Joule and theoretically by Mayer and Tyndall?

10. If the heat necessary to convert 50 pounds of ice into steam at 100° C. could be applied without loss to lifting the mass of ice, how high would it be raised? If a ball of iron weighing 150 pounds strike a target with a velocity of 1,200 feet per second, and the motion of the mass be converted into molecular motion, of which the ball takes up one-fourth, through how many degrees of temperature, centigrade, will the ball be raised? Specific heat of iron, 0.115.

11. Explain the formation of clouds. During the summer months, in the bay of Bengal, a vessel will probably find a SW monsoon instead of the trade-wind. What is the cause of this phenomenon?

12. How is the wet-bulb hygrometer employed to determine the hygrometric state? Explain the formation of the primary and the secondary rainbow.

LIGHT.

MONTHLY EXAMINATION.

FEBRUARY 24, 1874.—*Time allowed, two hours.*

1. Deduce the formula for determining the conjugate foci of concave mirrors. Show what change is necessary to adapt this to convex mirrors.

2. Find the deviation of the prism whose refracting-angle is A in terms of the angles of incidence and emergence; also, show how the index of refraction of such a prism may be determined from the deviation.

3. Deduce the formula for the double-convex lens—

$$\frac{1}{p}+\frac{1}{p'}=\frac{1}{f}.$$

4. Show that the intensity of the illumination of a plane surface is proportional to the cosine of the angle of incidence of the rays. It is found by means of Bunsen's photometer that the intensity of illumination of a certain gas-burner, placed at the distance of 25 feet from the screen, is equal to that of a standard candle placed 4 feet from the screen. Compare the intensities of the two lights.

Take any two of the four following:

5. A small plate is fixed on the floor of a room 9 feet distant from the wall; at wha height on the wall must a bracket gas-burner projecting 1 foot be placed, that the plate may receive the greatest possible direct illumination?

6. What must be the least length and the position of a plane mirror fixed against the vertical wall of a room in order that a man whose height is 6 feet may see his entire figure at one view? Would a shorter mirror serve the same purpose if inclined against the wall?

7. Show that a man looking in a mirror can place his finger in such a position upon it that, upon closing either eye, he will see only the open one.

8. Let A and B be two media separated by a plane surface; let v be the velocity of light in A, and v' that in B; show that, if $C\ D\ E$ be the path of the ray which occupies the least possible time in passing between any two fixed points, C and E, the ratio of the sines of the angles of incidence and refraction at D will be constant.

LIGHT.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, four hours; any two questions may be omitted.*

1. Prove that in the case of a concave mirror—

$$\frac{\text{length of the object}}{\text{length of the image}} = \frac{\text{distance of the object from the principal focus}}{\text{focal length}}.$$

2. Define the *critical angle* of a substance, and determine its measure. What is the greatest apparent zenith-distance which a star can have as seen by an eye below the surface of water, the index of refraction between air and water being $\frac{4}{3}$?

3. Deduce directly the formula for conjugate focal distances in the case of a convex lens.

4. A convex lens held 12 inches from a wall forms on it a distinct image of a candle; when the lens is held 6 inches from the wall, it is found that to produce a distinct image of the candle its distance from the lens must be doubled; find the focal length of the lens.

5. Define the *optical centre* and the *secondary axes* of a lens. Prove that every ray whose direction is unchanged by traversing a lens passes through the optical centre.

6. Show that in the case of a convex lens—

$$\frac{\text{length of the object}}{\text{length of the image}} = \frac{p-f}{f},$$

p denoting the distance of the object from the optical centre.

7. A person has 6 inches for his nearest limit of distinct vision; what kind of glasses must he wear, and of what focal length?

8. Draw a horizontal section of a spectroscope through the axes of the tubes. State the positions and uses of the important parts.

9. How is the presence of dark lines in the solar spectrum explained? Define the dispersive power of a prism, and deduce the algebraic expression for it.

10. Apply the principles of the undulatory theory of light to the case of reflection from a plane surface. In what respect do the vibrations of elliptically-polarized light differ from those of common light, and the latter from those of plane-polarized light?

11. How does the Newtonian differ from the undulatory theory of light in its explanation of the phenomena of refraction? How was the former disproved by Foucault's experiments?

12. Explain carefully how a particular wave-length may be determined by means of the diffraction-spectrum.

13. How may light be polarized by reflection? How is the extraordinary index of refraction defined?

14. Prove that, if in a homogeneous medium the force tending to restore a displaced particle to its original position of equilibrium is proportional to the displacement, the particle will describe an ellipse about that point as a centre.

DEPARTMENT OF STEAM-ENGINERY.

STEAM.

ANNUAL EXAMINATION.

MAY 25, 1874.—*Time allowed, five hours.*

I.

Sketch and describe the common (siphon) mercurial pressure-gauge, as applied to boilers and condensers, and the Bourdon pressure-gauge. Explain their several principles of action.

II.

What is the greatest pressure per square inch (by gauge) that may be employed in a cylindrical boiler 8 feet in diameter and 8 feet in length, made of iron plates of $\frac{1}{2}$ inch in thickness. Data: ultimate resistance of metal per square inch of section, 54000 pounds; factor of safety, 6; seams, double-rivetted.

III.

Calculate the horse-power from the following data: Mean pressure upon piston, 42.325 pounds per square inch (absolute); back pressure upon piston, 4.00 pounds per square inch (absolute); diameter of piston, 50″; stroke of piston, 42″; revolutions of engine, 60 per minute. Give also the boiler-pressure from the above data, the rate of expansion being 2, and the hyp. log. of 2 = 0.693.

IV.

Give the quantity of water, in pounds, that will be required to condense the steam discharged from a pair of cylinders of 50 inches diameter, and 42 inches stroke of piston, according to the following data: Revolutions of engine, 60 per minute; rate of expansion, 2; mean pressure, 42.325 pounds; hyp. log., 2=0.693; temp. of hot-well, 130° Fah.; temp. of injection-water, 60° Fah.; total heat, 1197°; latent heat, 916° weight of one cubic foot of steam, $\frac{1.23}{1000}$ pounds.

V.

Give the loss incurred by the practice of "blowing off" according to the data of question IV; the concentration of the sea-water being $\frac{1\frac{3}{4}}{32}$, by hydrometer, at 200° Fah., and the condenser a jet-condenser. Describe the means of ascertaining the concentration of water in marine-boilers, and the results of concentration when excessive; state why they should be averted.

VI.

Give the maximum speed that will enable a vessel to steam $1777\frac{7}{9}$ miles according to the following data: maximum speed of vessel at full power, 10 knots; consumption per day at that speed, 50 tons; coal on board, 300 tons; state also the quantity that will be consumed daily.

VII.

Sketch and describe a balanced (poppet) steam and exhaust valve; also some form of slide-valve, explaining the meaning of the terms *lap*, *lead*, and *cut-off*.

Sketch some form of independent expansion-valve.

VIII.

A steamer makes 10 knots (of 6086 feet) per hour; what is the slip according to the following data? Revolutions of screw per minute, 50; pitch of screw, 24 feet.

IX.

Sketch an indicator-diagram, and describe its uses.

X.

Describe a surface-condenser, stating in what respect it differs from the jet-condenser, and why it is generally preferred for marine-service.

DEPARTMENT OF ENGLISH STUDIES, HISTORY AND LAW.

LAW.

ANNUAL EXAMINATION.

MAY 21, 1874.—*Time allowed, five hours.*

[* Starred questions are alternatives.]

CONSTITUTION OF THE UNITED STATES.

I.

Describe the process by which a bill becomes a law.

With whom rests the power of impeachment? the power of trying impeachments? the power of trying cases of admiralty jurisdiction? of determining the rules of proceedings in either House of Congress? of originating bills for raising revenue? of defining and punishing offenses against the Law of Nations? of appointing consuls? of admitting new states into the Union? of declaring what officer shall act as President in case of the disability of both the President and Vice-President?

II.

State the provision of the Constitution with regard to (1) export-duties; (2) tonnage-duties; (3) unreasonable searches and general warrants; (4) religious tests.

What is said to be the supreme law of the land?

Give the substance of the XIII. Amendment; of the XV. Amendment.

Power to grant letters of marque and reprisal: to whom given? from whom withheld?

INTERNATIONAL AND MARITIME LAW.

III.

Describe the process by which International Law came into its present form, and show upon what basis it rests.

What is the objection to the word *law* as applied to the principles governing the relations of states? How can the use of the word be justified?

What are the sanctions of International Law?

III*.

Describe fully, (1) Municipal Law; (2) Civil Law; (3) Common Law; (4) Statute-Law; (5) Constitutional Law.

Discuss Kent's analysis of the elements of International Law.

IV.

1. The immunities of ambassadors as to (*a*) persons; (*b*) places.
2. The immunities and judicial power of consuls.
3. In a defensive alliance, when can the *casus fœderis* apply to a war offensive in its operations?
4. What is the objection to the transfer of property *in transitu* during war?
5. State the circumstances and discuss the bearings of the Silesian Loan case.

IV*.

State in full the law as to the confiscation of enemy's property and debts found in the country on the breaking out of a war. Apply it to the following cases, showing in each case the principles on which the law rests:—

1. Enemy's public property.
2. Enemy's private property.
3. Debts due the enemy.

4. Stocks held by the enemy.
5. Government bonds held by the enemy.

What exception to the law was made by England in the Crimean War?

V.

1. Define blockade.
2. In what two ways may a neutral have notice of the existence of a blockade?
3. How does this affect the question of the neutral's guilt in sailing for a blockaded port?
4. How is the act of sailing for such a port considered?
5. How long do the offense and liability of a ship breaking a blockade continue?
6. In prize-cases, when are damages awarded against the captor?

V*.

State in full the distinction drawn as to freight, ship, and cargo in adjudging upon a neutral the penalty for—

1. Carrying enemy's property (before 1856).
2. Breach of blockade.
3. Carrying contraband.
4. Rescue of prize.
5. Carrying enemy's dispatches.
6. Resistance to the right of search.

VI.

Explain fully any five of the following:—

1. Bottomry-bonds.
2. Registry, enrollment, and license.
3. General average.
4. Bill of lading.
5. Stoppage *in transitu*.
6. Domicile.
7. Postliminy.
8. Rule of 1756.

VII.

1. State in full the reasons for and against the rule subjecting property at sea to capture and confiscation during war.
2. What must be the nationality of a prize-court, and where can it sit?
3. Has a prize-court jurisdiction over prizes in neutral ports?
4. How is a license to trade regarded by cruisers of the government granting it? by cruisers of an ally? by cruisers of the enemy?
5. State the provisions of the declaration of the Congress of Paris in 1856.

VII*.

1. Name the ship's papers required both by International and Municipal Law, and describe charter-party, clearance, shipping-articles, and sea-letter.
2. State the circumstances connected with the capture of the Florida in Bahia, and show fully the bearing of the law on the case, and on the relations of the governments concerned.
3. What must be done with captures made after a treaty of peace?
4. If one party to a treaty violates it, is the treaty void?

VIII.

In the case of a war between the United States and France, in command of the United States steamer Constellation, cruising in the West Indies, you recapture an American brig, having on board a prize-crew from her captor, the Insurgente, and bound to Mar-

tinique for adjudication. Describe all the consequences of the recapture, stating what you do with the prize, and what becomes of her finally; in general, show how all parties are concerned, giving reasons.

Some days after, you capture a brig owned in Bahia, and engaged in carrying contraband to France. She is taken into port and condemned on that ground. It appears that she was originally an American vessel, but was captured early in the war by the French, condemned as enemy's property, and sold to a Brazilian firm. The original owner puts in a claim. How is it to be decided?

IX.

Next day you search a Dutch (neutral) brig, bound from Guadeloupe to Copenhagen. You discover a packet addressed to the French ambassador at Copenhagen, from the governor of the island. The master does not voluntarily disclose the packet, nor does he practice any fraud. What would you do? What consequences would flow from your act?

Later, you speak a vessel, flying the Swedish (neutral) flag, about 14 miles out from Kingston. You attempt to search her, but only succeed by overcoming a forcible resistance. On examination, you find that she is a French merchantman, having on board a cargo partly French and partly neutral. You find that her condition is such that extensive repairs will be necessary before she can make a long voyage. What is to be done, and what results flow from your action?

X.

Later, you search a barque sailing from Rio to Havana, under Spanish colors. You find that the owner is a Frenchman, who has resided for the last three years in Havana What would you do? Supposing that you captured the vessel and sent her in, what would be the decision of the court?

Next day, you fall in with two vessels, both American, and trading between New York and Martinique; one, a brig, under a license from the French government; the other, a barque, under a license from the Department of State of the United States. What would you do?

Later, you find a third vessel, a neutral, licensed like the last, bound for Martinique from Halifax, having on board artillery-saddles and uniforms, which the owner of the ship is sending as a part of the cargo, along with other merchandise belonging to himself and to other parties.

Consequences?

DEPARTMENT OF MODERN LANGUAGES.

SPANISH.

ANNUAL EXAMINATION.

MAY, 1874.—SPECIMEN QUESTIONS.

Translate into Spanish:

They do what they can, but not what they wish.
What is the matter with you?
I have a sore arm and cannot work.
But you can write, can you not?
No, sir; because I cannot raise my arm.
Can your children write and read?
The elder can read a little.
What is there new this morning?
I do not know; I have not been out yet.
At what hour shall I go out?
A little later, between nine and ten o'clock.
If you had money, would you lend me some?
No, because you are a great spendthrift.

I would be able to pay you to-morrow evening.

Which do you like most, tea or coffee?

Waiter, bring three glasses of wine and two of tea.

Will you be here at our house Wednesday morning?

Remain at home until my return.

I have to go to market at ten o'clock.

It will not be necessary to go there to-day.

Why do you not take off your hat when I enter?

I was studying, sir, and did not see you.

Conjugate the verb *ser* in all moods and tenses.

Translate the following verbs, and give their past participles: *abrir, morir, ver, poner, hacer, decir, escribir.*

How are English nouns ending in *ty* or *dy* usually rendered in Spanish?

Define an impersonal verb, and give an example.

Give the cardinal numbers from one to twelve.

What is a reflective verb?

How many conjugations are there, and how are they distinguished?

Translate into English:

I.

Querido amigo:

Temes que estoy necesitado, y quieres dividir conmigo lo poco que tienes! Mereces que te levantar estatuas, y si fuera este el tiempo de la gentilidad tú serias adorado como á Dios de la amistad. Es triste verse en necesidad, pero es muy consolante encontrar almas tau tiernas y tan grandes como la tuya que la compadezcan. Y quieres ahora forzar mi gratitud al silencio?

Esto no puede ser, amigo mio. Permite pues que te diga que mi gratitud será pura y mi afecto eterno. Enviame la mitad de lo que me ofreces, y esto será bastante para hacer muy rico á tu pobre amigo.

II.

Queridos discípulos y amigos:

El gefe del departamento y los instructores en el ramo de Español, que comprenden cuan feliz es el momento en que un estudiante recibe su diploma, se adelantan hoy á congratular tanto á vosotros como á vuestras familias por el cercano evento, y se complacen en declarar que vuestra conducta ha sido digna de los que recibiran el noble titulo de oficiales de la marina americana. Pero como nuestras relaciones van á cesar, permitidnos algunas reflexiones que el interes por vuestro porvenir nos inspira.

Refrescad de tiempo en tiempo con vuestros libros las ideas adqueridas, y veréis que la teoria toma formas y se da la mano con la practica, y por lo que toca á los lenguages no olvideis que lo mas necesario es usar desde luego lo que ya sabeis.

Muchos son los puertos en dondo el idioma español se habla, en todos ellos encontraréis admiradores, sea de vuestras instituciones, sea de las gracias que acompañan siempre á la juventud. Convencidos de esto no tengais miedo del ridículo al hablar el Español. Los nativos estarán contentísimos de interpretar vuestros pensamientos y os ayudarán en vuestras dificultades. Hablad pues: Su voz clara y dulce formará vuestro oido. Hablad pues sin temor, porque en vuestra edad hasta los tropiézos de un estrangero son un adorno.

Sed moderados en vuestros placeres, sin olvidar la máxima de Don Quijote que "el vino demasiado no guarda secreto ni cumple palabra." Como soldados del pueble, sea vuestra divisa la que hay escrita en las famosas espadas de Toledo "no me saques sin razon, no me embaines sin honor."

Que Dios dirija vuestros pasos y estad seguros que si cualquiera de vosotros se distingue algun dia por alguna accion de noble humanidad, ó de brillante bravura militar, el gefe del departamento y vuestros instructores de Español al relatarla á los que queden en la escuela para que les sirva de ejemplo, exclamarán con orgullo: "Este tambien ha sido uno de nuestros discípalos."

Dios os guarde, señores: El gefe y los instructores del ramo de Español.

CADET-ENGINEERS.

FIRST CLASS.

DEPARTMENT OF PHYSICS AND CHEMISTRY.

CHEMISTRY.

SEMI-ANNUAL EXAMINATION.

JANUARY, 1874.—*Time allowed, two hours.*

1. Explain the distinction between chemical compounds and mechanical mixtures. Under which head does *air* come, and what are the proofs?

2. What are the products of the combustion of coal? What are the conditions for the production of the maximum of heat from a given quantity of fuel?

3. Explain the chemistry of steam-boiler incrustation resulting from the action of (1) fresh water and (2) sea-water.

4. Give the *rationale* of soap-manufacture, with the chemical constitution of the saponifiable fats.

5. Interpret the following formulas, giving chemical and common names:

$$H_2SO_3,\ SiO_2,\ HKCO_3,\ NH_4NO_3,\ Hg_2Cl_2,\ CuSO_4,\ 5H_2O,\ \left.\begin{matrix}C_2H_5\\H\end{matrix}\right\}O,\ \left.\begin{matrix}C_6H_5\\H\end{matrix}\right\}O,$$

$$\left.\begin{matrix}C_6H_5\\H\\H\end{matrix}\right\}N,\ \left.\begin{matrix}C_3H_5\\(NO_2)_3\end{matrix}\right\}O_3.$$

6. Discuss the principle and applications of the so-called galvanic action of two or more metals in contact, and in the presence of corroding agents.

7. What compounds constitute the ordinary ores of iron, zinc, tin, lead, copper, silver, mercury, and gold? Give formulas.

8. What is the chemical constitution of cast iron? How is it converted into wrought iron and steel? Give the chemical phenomena of the processes.

CHEMICAL ANALYSIS (QUALITATIVE).

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, five hours.*

One of the following complex substances was given to each Cadet:

1. White paint in oil (zinc white);
2. White paint in oil (impure lead white);
3. Green paint in oil (Prussian blue and chrome yellow);
4. Fresh-water boiler-scale;
5. Rumford yeast-powder (acid phosphate of calcium and bicarbonate of soda);
6. Ultramarine blue, dry;
7. Type-metal;
8. German silver.

(The oil-paints were washed free of oil and dried, after the Cadets had shown that they knew how this was effected.)

ELECTRICITY AND MAGNETISM.

MONTHLY EXAMINATION.

APRIL, 1874.—*Time allowed, two hours.*

1. Explain the construction and use of resistance-coils.

What would be the resistance of three wires in multiple-arc, whose respective resistances are 8, 25, 45 ohms?

2. Suppose two uniform conductors of unequal resistances, to be represented by the lines CD and FG; the first conductor is 8 kilometers, and the second, 24 kilometers long; the difference of potential between C and D, and between F and G is 25 volts. If one end of a galvanometer-wire be attached to the first conductor, 3 kilometers from

C, at what point of FG must the other end of the galvanometer-wire be attached in order that there shall be no deflection of the needle?

3. Describe the construction, mode of action, important applications, and defects of magneto-electrical machines.

4. Give a method for determining the position of a fault in a telegraph-line, when the fault is large, and its resistance nearly constant.

5. How can the position of a fault be found by means of a return-wire, so that the result shall not be affected by any variation in the resistance of the fault?

ELECTRICITY AND MAGNETISM.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, five hours.*

1. What is the meaning of the word *potential* as used in electricity? How may the difference of potential be measured?

2. Make it evident that you know the direction of currents induced in a neighboring conductor by the change of position of a magnet, or of a wire through which a current is passing, or by the increase or decrease of the strength of the magnet, or of the current in the wire. What common properties have solenoids and magnets?

3. What is an *ion*? What determines the quantity of an electrolyte decomposed? If an absolute electro-magnetic unit of current decomposes in one second 0.00092 grammes of water, how much silver will be deposited per hour by a current produced by a battery of a constant electro-motive force of 56 volts, overcoming a resistance of 8 ohms?

4. In a thermo-electric pile, to what is the work done by the current equivalent? What is an expression, containing the mechanical equivalent of heat, for the electro-motive force absolutely necessary to effect the decomposition of an electrolyte?

5. Explain the construction and action of Carré's dielectrical machine. Explain the construction and action of Thompson's reflecting electrometer.

6. If the difference of potential between A and B is maintained at 28 volts, and three points be connected in multiple-arc by two wires of 5 and 12 ohms resistance, respectively, what will be the strength of the current measured in farads? Describe the construction and action of Grove's cell.

7. Compare the cost and advantages of the potential energy, mechanical energy, and useful mechanical effect resulting from the consumption of zinc in a galvanic battery with those developed by the use of coal in the ordinary engine. Describe the construction and special advantages of the Siemen's armature.

8. What is the most important electro-motor in use? Explain how telegraphic messages can be sent simultaneously in both directions through one wire. Describe some method of determining the position of a fault in a telegraph-line.

9. Explain the construction and use of the Wheatstone bridge. What determines the choice of a galvanometer for a special purpose?

In the department of Physics and Chemistry, the papers set for the Cadet-Engineers of the First Class, in the subject of *Mechanics and Applied Mathematics*, are the same as those set for the Cadet-Midshipmen of the Second Class, and in the subject of *Heat*, the same as those set for the Cadet-Midshipmen of the First Class.

DEPARTMENT OF STEAM ENGINERY,

STEAM-ENGINERY.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, four hours.*

I.

Describe the various strains to which material may be subjected, giving an instance of each from the steam-engine. Explain the meaning of the terms: ultimate strength, proof-strength, working-load, set, resilience, factor of safety.

II.

Calculate the greatest pressure in pounds per square inch that may be employed in a cylindrical boiler of 8 feet diameter, containing a cylindrical furnace-flue of 4½ feet diameter, and ½ inch thickness, built in three sections of 2 feet each, and strengthened at the ends of the sections beyond the ultimate strength of the plate. Factor of safety, 6.

III.

Give the thickness of the shell of the boiler described in question II; the shell being double-riveted, and the tensile strength of boiler-plate being taken at 54000 pounds per square inch of cross-section.

IV.

What would be the least diameter of wrought-iron brace-rods for opposite segmental portions of the heads of a cylindrical boiler of 8 feet diameter and 8 feet in length; the versed-sine of the segments being 2½ feet, the braces 18 in number, and the pressure per gauge 80 pounds?

V.

Define *moment of flexure* and *leverage*, and give the formulas for resistance to cross-breaking under the five general conditions. Give the breadth and thickness of a solid wrought-iron crank of an engine of 10 feet stroke of piston, by which 500 horse-power is developed, with a piston-speed of 500 feet per minute. Initial pressure (absolute), 40 pounds per square inch.

VI.

The cast-iron dome surmounting the steam-drum of a boiler carrying 80 pounds of steam is spherical, with a radius of 1 foot. The dome being flanged, and secured by bolts, what is the nature of the strains at its base, and what thickness will suffice to resist them, taking 8 as the factor of safety, and 15,000 pounds as the tenacity?

VII.

What is meant by absolute zero? How is it determined?

VIII.

If 3 pounds of coal of the components, $C = 0.915$, $H = 0.035$, $O = 0.026$ are required to develop a horse-power per hour, what per centum of the fuel is utilized, and to what causes may be attributed, the loss of the remainder?

IX.

Calculate the number of pounds of air required for the perfect combustion of one ton (2240 pounds) of coal, and the number of pounds of water it should evaporate under atmospheric pressure from a temperature of 110° Fah.

X.

Draw diagrams from the same cylinder, using the same pressure, viz, 80 pounds per gauge, as follows:

(*a*) A pair of diagrams, showing cut-off ⅓ from beginning of stroke, supposing the engine to be condensing.

(*b*) A pair of diagrams, showing cut-off at ⅓ from the beginning, supposing the engine to be non-condensing.

(*c*) A pair of diagrams (condensing), designed to cut-off at ½-stroke, but showing the eccentric to have slipped backward apparently 45°.

(*d*) A pair of diagrams (non-condensing), designed to cut-off at ½-stroke, with valve-stem considerably too long.

SECOND CLASS.

DEPARTMENT OF MATHEMATICS.

DESCRIPTIVE GEOMETRY.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, five hours.*

1. Pass a plane through A ... (4.0, 1.5, 1.0), making an angle of 45° with V and 60° with H.

Pass a plane through B ... (4.5, 1.75, 0.5), making an angle of 75° with V and 45° with H.

Find the shortest distance between the line AB, and the intersection of these two planes.

1*. Draw a line through the point A ... (4.5, 1.0, 2.0), making an angle of 45° with V and 30° with H.

Suppose this line to revolve about the fixed line which passes through A and B ... (3.5, 1.5, 0.0), always remaining at the same angle with it. Find the horizontal and vertical projections of the surface so generated.

Pass a plane tangent to this surface through the point ... (5.5, 1.0, 1.0).

2. A ring is generated by the revolution of a circle about an axis in its plane; find the true form of a section of this ring made by a plane tangent to its inner surface; take the centre of the generating circle at ... (6.0, 3.0, 1.0), and its radius $\frac{3''}{4}$; the axis vertical and passing through ... (4.0, 3.0, 0.0), the cutting-plane perpendicular to V, and making an angle of 45° with H.

2*. A spheroid is generated by the revolution of an ellipse, whose semi-axes are 1.25 and 0.75, about its major axis. Taking the centre of the ellipse at ... (3.0, 2.0, 2.0), and its major axis vertical, find the true form of a section of the spheroid made by a plane passing through the upper vertex of the ellipse, perpendicular to V, and making an angle of 60° with H.

Pass a plane tangent to the spheroid at a point of its upper surface, the horizontal projection of which is at ... (3.5, 1.5, 0.0).

3. Two cones, each having a circular base, stand on H. The radius of the base of the first is 2″, and centre at ... (3.0, 2.5, 0.0); and its vertex is at ... (3.5, 2.0, 1.5); the radius of the base of the second is 1″.5; its centre is at ... (3.25, 2.5, 0.0); and its vertex at ... (4.5, 0.5, 2.5); it is required to find the horizontal and vertical projections of their intersection.

3*. An hyperboloid is generated by the revolution of the indefinite line A ... (2.0, 1.75, 2.25), B ... (4.75, 1.0, 0.0), about a vertical axis passing through ... (3.5, 2.25, 0.0); find the horizontal and vertical projections of the surface so generated, and find the true form of a section of this surface made by a plane perpendicular to V, and parallel to an element of the asymptotic cone; let this plane pass through the right-hand extremity of that diameter of the circle of the gorge which is parallel to the ground-line.

4. Construct the tetrahedron V-ABC, having given—

C ... (4.5, 1.5, 1.0),	CV, ... 1″.5.
B ... (3.0, 2.0, 1.5),	BV, ... 2″.0;
A ... (2.0, 1.0, 1.0),	AV, ... 2″.25;

Circumscribe a sphere about this tetrahedron.

4*. Pass a plane tangent to the three spheres whose centres are at the points ... (2.0, 0.5, 1.0), ... (4.5, 1.5, 1.0), and ... (3.5, 2.25, 0.75); and whose radii are respectively $\frac{1''}{2}$, $\frac{3''}{4}$ and $\frac{3''}{8}$.

The papers set for the Cadet-Engineers of the Second Class in *Algebra, Plane Trigonometry, and Analytical Geometry* were the same as those set for the Fourth Class of Cadet-Midshipmen in January and for the Third Class of Cadet-Midshipmen in January and May.

* Alternatives.

DEPARTMENT OF STEAM-ENGINERY.

MECHANICAL DRAWING.

ANNUAL EXAMINATION.

MAY, 1874.—*Time allowed, four hours.*

1. Define the following terms: pitch and pitch-circle; point and point-circle; root and root-circle; face and flank. Define the following curves, show how they are generated, and sketch one of each: cycloid, epicycloid, hypocycloid, and involute.

2. Show that involutes are proper curves for the teeth of wheels.

3. Find the radii of the tooth-curves.

4. Sketch a common three-ported slide-valve, give it *lap* and *lead*, and explain the relative positions of the eccentric and piston. Name the four fundamental functions of the valves, and state at what edge each function is performed.

5. What is angular advance? Show that angular advance affords admission for a new stroke, cut-off, exhaust-closure, and release, all at an equal number of degrees before reaching a dead-point.

6. Show that steam-lap, corresponding to a certain number of degrees from the zero-diameter, postpones admission for an equal number of degrees beyond the dead-point, produces cut-off at the same number of degrees before the dead-point, with relea e and exhaust-closure at the dead-point.

7. What is exhaust-lap? Show that exhaust-lap prolongs expansion and hastens compression.

8. What is lead? Demonstrate that the angular advance estimated from the zero-radius is equal to the sum of the lap and lead angles estimated from the same point.

9. Demonstrate that when the steam-port is open by the amount of the lead, the exhaust-port is open by the amount of the lap and lead.

10. Sketch a Stephenson's link-motion, and demonstrate how one position of the link may be found.

STEAM.

ANNUAL EXAMINATION.

MAY 21, 1874.—*Time allowed, five hours.*

1. Given, for an engine of 36-inch stroke of piston, the initial pressure, 30 pounds (per gauge); vacuum, 26 inches; cut-off, 2 feet from beginning of stroke. Required the mean pressure; back pressure; mean unbalanced pressure; and terminal pressure.

Datum.—Neglecting clearance, hyp. log. $1\frac{1}{2} = 0.405$.

2. Sketch and describe Allen and Wells's cut-off gear, and the right and left hand screw-slide cut-off valve (Mayer's), as applied to the United States steamer Wabash.

3. Sketch and describe the following pressure-gauges: Bourdon, common mercurial siphon-gauge, and a form of the latter in which the branches are multiplied; explaining their principles of action as applied to boilers and condensers.

4. A vessel steams $10\frac{3}{4}$ knots per hour, making 62 revolutions per minute, the slip being 12 per centum of the speed of the screw; required the pitch of the latter. Length of knot, 6086 feet.

5. Given, the diameter of piston, 36 inches; stroke, 36 inches; cut-off, 27 inches from beginning; space in clearance and passages, 2 cubic feet per stroke; pressure of steam, 30 pounds per gauge; revolutions, 60 per minute; volume, 610; temperature of steam, 276°.4 Fah.; pounds of coal consumed per hour, 2000; density of water in boilers, $\frac{17}{32}$; feed-water, 110° Fah. Required, the number of pounds of water evaporated per pound of coal.

6. In the last example, supposing the feed-water to be heated to a temperature of 150° Fah., what per centum will be the gain in fuel?

7. Draw an ideally perfect indicator-diagram from a condensing-engine; pressure, 25 pounds per gauge; vacuum, 26 inches. Draw upon the diagram dotted lines, showing how its figure will be modified by the following accidents:

Too great and too little lead; too great compression; scantiness of opening of ports.

8. Describe the apparatus known as Sewell's surface-condenser, mentioning any peculiarities that pertain to the pumps used in connection with it.

9. Given, the diameter of the cylinder of a non-condensing engine, 2 feet; the stroke of piston, 6 feet; pressure per gauge, 40 pounds; cut-off at $\frac{1}{3}$ from beginning of stroke; revolutions, 70 per minute; back pressure, 2 pounds above the atmosphere.

Draw the indicator-diagram, and calculate the horse-power, neglecting clearance.

10. State the advantages derived from the practice of surface-condensation in general.

ERRATA.

On page 7, in place of CAPTAIN KIDDER RANDOLPH BREESE, read COMMANDER EDWARD TERRY; in place of *Commandant of Midshipmen*, read *Commandant of Cadets.*

On page 8, after PASSED ASSISTANT ENGINEER THOMAS WHITESIDE RAE, insert C. E.

INDEX.

Annual register 1874-1875 i20246717